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3B

Chemical Processors, Inc.
Pier 91 Dangerous Waste Treatment and Storage Facility

Permit Application

Submitted to Washington Department of Ecology
and EPA Region X

CHEMICAL PROCESSORS, INC.

2203 AIRPORT WAY SO., SUITE 400
SEATTLE, WASHINGTON 98134
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VOLUME II

USEPA RCRA



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#433

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Pier 91 Dangerous Waste Treatment and Storage Facility

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WASTE MANAGEMENT BRANCH

September, 1988

CHEMICAL PROCESSORS, INC.

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VOLUME II

SECTION C
WASTE CHARACTERISTICS

SECTION C. WASTE CHARACTERISTICS

TABLE OF CONTENTS

SECTION	PAGE
C1.0 Chemical and Physical Characteristics of Wastes	C1
C1.1 Waste Characteristics	C1
C1.2 Wastes in Tank Systems	C4
C2.0 Waste Analysis Plan	C10
C2.1 Facility Description	C10
C2.2 Identification of Wastes and Restricted Wastes	C13
C2.3 Process Descriptions	C15
C2.4 Sampling and Analytical Methodology	C16
C2.4.1 Sampling Methods and Equipment	C17
C2.4.2 Frequency of Sampling and Analysis	C19
C2.4.3 Sampling Procedures	C20
C2.4.4 Analytical Rationale and Parameters	C21
C2.4.5 Analytical Test Methods	C31
C2.5 Quality Assurance and Quality Control	C32
C2.5.1 Sampling Techniques: QA/QC	C33
C2.5.2 Analytical Methods and Results: QA/QC	C35
C2.5.3 Selection/Specification of an Outside Laboratory	C37
C2.5.4 Chain of Custody Procedures	C38

TABLE OF CONTENTS (concluded)

SECTION	PAGE
C2.6 Requirements for Incoming Wastes	C38
C2.6.1 Waste Profile System	C38
C2.6.2 Waste Check-In Procedure	C42
C2.7 Requirements for Ignitable, Reactive or Incompatible Wastes	C44
C2.8 Record Keeping and Waste Tracking	C46
C2.8.1 Record Keeping	C46
C2.8.2 Waste Tracking Procedures	C47
Appendix C-1 Typical Analyses of Wastes	
Appendix C-2 Analytical Methods	
Appendix C-3 Quality Assurance/Quality Control	
Appendix C-4 Waste Tracking Forms	
Appendix C-5 Exceptions to the Waste Profile System Sample Submittal Requirement	

LIST OF TABLES

TABLE		PAGE
C1-1	Waste Characteristics	C3
C1-2	Wastes in Tank System	C6
C1-3	Properties of EHW Wastes Which Can Be Present in Tanks Holding Solvents	C7
C2-1	Storage and Treatment Tanks	C12
C2-2	Sampling Methods and Equipment	C18
C2-3	Sample/Container Compatibility	C19

LIST OF FIGURES

FIGURE		PAGE
C1-1	Existing Dangerous Waste Tank System and Processing Area	C5
C2-1	Waste Profile System	C40

SECTION C. WASTE CHARACTERISTICS

Revised, January 1990

This section describes the characteristics of wastes managed at the Chemical Processors, Inc. Pier 91 Facility. This section also contains the Pier 91 Facility Waste Analysis Plan which explains how the waste characteristics are determined. A description of the facility and the processes is summarized in the Waste Analysis Plan, Section C2.0. A more detailed description of the facility and the processes is found in Sections B (Facility Description and General Provisions) and D (Process Information).

C1.0 CHEMICAL AND PHYSICAL CHARACTERISTICS OF WASTES

40 CFR 270.14(b)(2), 264.13(a)
WAC 173-303-806(4)(a)(ii), 300(1)-(5)

This section describes the chemical and physical characteristics of the wastes stored, treated or generated at the Chemical Processors, Inc. Pier 91 Facility. Section C1.1 describes the characteristics of the most commonly managed wastes that are generated off site and on site. Section C1.2 describes the characteristics of wastes in tank systems and the properties of the vapors, fumes or other emissions from tanks holding wastes designated extremely hazardous waste (EHW).

C1.1 Waste Characteristics

Revised, January 1990, May 1991

This section summarizes the characteristics of the dangerous wastes which are managed at the Pier 91 Facility. Wastes are variable in nature. This list contains the wastes most

consistently handled at the Chemical Processors, Inc. Pier 91 Facility to date.

Any waste listed in the Pier 91 Facility Part A Permit Application may be managed on site. However, the wastestreams most commonly handled at the Pier 91 Facility can be divided into the following categories:

- Oil and Coolant Emulsions
- Industrial Wastewaters including Alkalies
- Industrial Waste Sludges

A description of the most typically handled wastestreams, the associated dangerous waste numbers, estimated monthly volume treated and the designation is in Table C1-1, Waste Characteristics. Each waste described has an associated waste identification number by which it is referenced in all related tables and appendices. Typical analyses of each wastestream are given in Appendix C-1.

Wastes generated on site are variable in nature. All liquid wastes generated on site are treated on site whenever possible prior to shipment to an off-site TSD Facility. Prior to shipment, wastes generated on site are sampled and analyzed as described in Section C2.0, Waste Analysis Plan. Waste generated onsite are labeled at the point of generation. The wastes are designated using the procedures in WAC 173-303-070 through 104.

The wastes generated on site can be generally divided into the following categories:

- sludges from industrial wastewater treatment
- Clean-up debris consisting of potentially contaminated soil, sampling equipment, protective clothing, absorbent and other debris
- spent carbon from carbon adsorption system.

TABLE C1-1. WASTE CHARACTERISTICS

Sheet 1 of 1

WASTE ID NUMBER (a)	ESTIMATED VOLUME (GAL/MONTH)	POSSIBLE DANGEROUS WASTE NUMBER(S)	DESIGNATION
<u>Oil and Coolant Emulsions</u>			
1	4,100	WT01, WT02	DW/EHW
2	22,000	WT01, WT02	DW/EHW
3	20,000	WT01, WT02	DW/EHW
4	37,000	WT01, WT02	DW/EHW
5	1,150	WT01, WT02	DW/EHW
6	16,000	WT01, WT02	DW/EHW
7	500	D001	DW
8	12,000	WT01, WT02	DW/EHW
9	4,000	WT01, WT02	DW/EHW
10	8,000	WT01, WT02	DW/EHW
11	1,500	WT01, WT02	DW/EHW
12	600	WT01, WT02	DW/EHW
13	11,000	D001, WT01, WT02	DW/EHW
14	500	WT01, WT02	DW/EHW
15	1,200	F004	DW
16	4,000	F002, F003, F005	DW/EHW
<u>Industrial Wastewaters</u>			
17	10,000	WT01, WT02	DW/EHW
18	15,000	WT01, WT02	DW/EHW
19	2,500	D007, WT01, WT02	DW/EHW
20	3,000	D007, D008, WT01, WT02	DW/EHW
21	500	WT01, WT02	DW/EHW
<u>Industrial Waste Sludges</u>			
22	8,000	D004-D011	DW/EHW

(a) Names of wastestreams are proprietary customer information

Since many of the wastes generated on site consist of contaminated materials and treatment products, the wastes will have many of the characteristics of wastes which have been accepted for treatment.

C1.2 Wastes in Tank Systems

Revised, January 1990, December 1990, November 1991

40 CFR 264.191(6)(2), 264.192(a)(2)

WAC 173-303-640(2)(c) and (d), 640(3)(a)

The following types of waste are presently stored or treated in tanks:

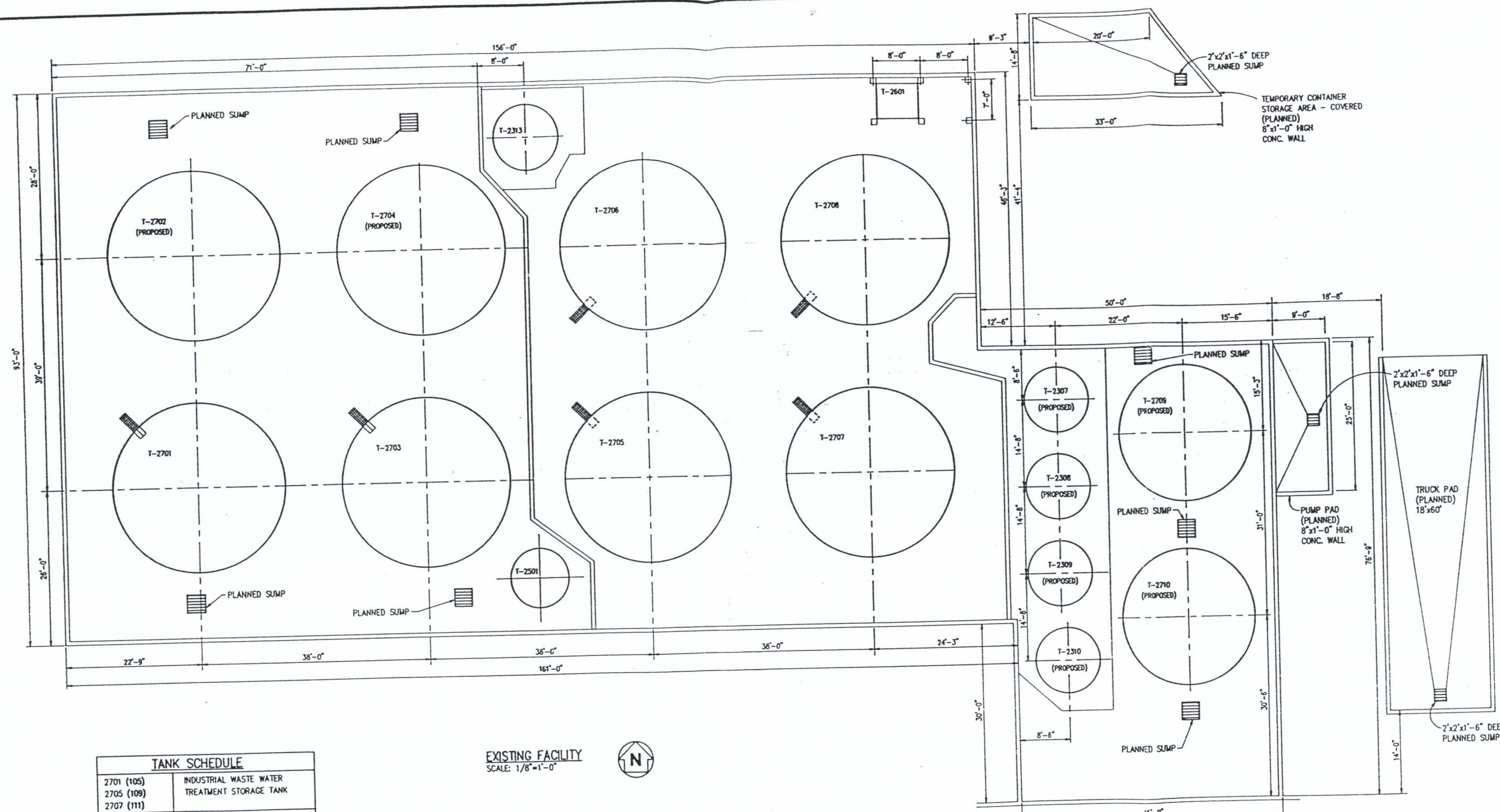
- Oil and Coolant Emulsions
- Industrial Wastewaters including Alkalies
- Industrial Waste Sludges

Table C1-2, Wastes in Tank System, describes the wastes managed in the tank system, including the associated sumps, and the storage and/or treatment process for these wastes. The layout of the tanks is shown in Figure C1-1, Existing Dangerous Waste Tank System and Processing Area. The tank capacities and functions are described in Section C2.1. All dangerous waste tanks could potentially hold wastes designated extremely hazardous waste (EHW).

Some wastes are designated EHW because they exhibit the characteristic of EP (Extraction Procedure) toxicity based on metal concentrations. The metals are precipitated during treatment rather than volatilized, therefore no properties of fumes from metals are described in this section. Refer to Section B, Facility Description, for a discussion of the Chemical Precipitation treatment process.

Wastes treated on site are also designated EHW because they are assumed by the generator to exhibit the characteristic of toxicity (WAC 173-303-101).

DWs and EHWs can be stored in the following tanks: 2101-2104, 2201, 2204, 2301-2306, 2401 and 2402. The centrifuge (process equipment) is used for the treatment of EHWs.



TANK SCHEDULE	
2701 (105)	INDUSTRIAL WASTE WATER TREATMENT STORAGE TANK
2705 (109)	
2707 (111)	
2702 (PLANNED)	
2704 (PLANNED)	
2703 (107)	WASTE OIL TREATMENT/STORAGE TANK
2708 (112)	
2706 (110)	OIL/COOLANT TREATMENT AND STORAGE TANK
2709 (PLANNED)	WASTE OIL STORAGE TANK
2710 (PLANNED)	
2313 (164)	HEATED TREATMENT/STORAGE
2307 (PLANNED)	HEATED TREATMENT AND STORAGE TANK
2308 (PLANNED)	
2309 (PLANNED)	
2310 (PLANNED)	
2501	TREATMENT CHEMICAL STORAGE (NOT RCRA-REGULATED)
2601	CENTRIFUGE

EISI
consulting engineers
1800 West Emerson Place
Suite 200
Seattle, Washington 98199

11-19-81	ADDED PUMP PAD AND TRUCK PAD
11-19-81	INITIAL RELEASE
BURLINGTON ENVIRONMENTAL	
PIER 91 FACILITY - DANGEROUS WASTE TANK SYSTEM & PROCESSING AREA	
DATE: 1/8"-1'-0"	PROJECT NO: D-88-21-S2
1	1

TABLE C1-2. WASTES IN TANK SYSTEM
Revised, January 1990, July 1990, December 1990, November 1991

TANKS	PROCESS	POSSIBLE WASTES MANAGED-BY WASTE IDENTIFICATION NUMBER ^(a)
2703, 2706, 2708-2710	Oil and Coolant Emulsion Storage	1-16
2701, 2702, 2704, 2705, 2707	Industrial Wastewater Storage	17-21
2307-2310, 2313	Heated Treatment and Storage	1-22

(a) Refer to Table C1-1 for waste identification number description

The properties of the constituents designated EHW possibly stored in these tanks are listed in Table C1-3. The list of constituents includes F-listed solvents, and other common industrial solvents. These constituents are generally in very low concentrations, i.e. part per million ranges. The information provided in Table C1-3 was obtained from the following references: The Merck Index (1983), Dangerous Properties of Industrial Materials (6th Edition) or Hawley's Condensed Chemical Dictionary (11th Edition).

Engineering and operational controls for potential vapor releases are discussed in Section D, Process Information.

TABLE C1-3. PROPERTIES OF EHW WASTES WHICH CAN BE PRESENT IN TANKS HOLDING SOLVENTS
Sheet 1 of 3

CONSTITUENT & CHEMICAL FORMULA	DESCRIPTION	FLASH POINT	VAPOR PRESSURE (mm Hg)
Methylene Chloride CH_2Cl_2	Colorless volatile liquid; Penetrating ether-like odor;	1224°F ^(b)	380 mm @ 22°C
1,1,1-Trichloroethane $\text{C}_2\text{H}_3\text{Cl}_3$	Colorless liquid	(c)	100 mm @ 20°C
1,1,2-Trichloroethane $\text{C}_2\text{H}_3\text{Cl}_3$	Clear, colorless liquid; Sweet odor;	(c)	17 mm @ 20°C
Perchloroethylene C_2Cl_4	Colorless liquid; Ether-like odor;	(c)	16 mm @ 22°C
Trichloroethylene C_2HCl_3	Stable colorless liquid; Chloroform-like odor;	(c)	100 mm @ 32°C
Toluene $\text{C}_6\text{H}_5\text{CH}_3$	Colorless liquid; Aromatic odor;	40°F	37 mm @ 30°C
Triethylamine $(\text{C}_2\text{H}_5)_3\text{N}$	Colorless liquid; Ammonia odor;	10°F	(a)
Methyl Isoamyl Ketone $\text{CH}_3\text{COC}_2\text{H}_4\text{CH}(\text{CH}_3)_2$	Colorless, stable liquid; Pleasant odor;	110°F	(a)
Ethyl Benzene $\text{C}_6\text{H}_5\text{C}_2\text{H}_5$	Colorless liquid; Aromatic odor;	59°F	10 mm @ 26°C
Xylene $\text{C}_6\text{H}_4(\text{CH}_3)_2$	Clear, colorless liquid Aromatic odor;	81-90°F	7 mm @ 21°C

TABLE C1-3. (continued)

Sheet 2 of 3

CONSTITUENT & CHEMICAL FORMULA	DESCRIPTION	FLASH POINT	VAPOR PRESSURE (mm Hg)
Cyclohexanone $C_6H_{10}O$	Water-white to pale yellow liquid; Acetone and peppermint-like odor;	111°F	10 mm @ 39°C
Benzene C_6H_6	Clear colorless to light yellow liquid; Aromatic odor;	12°F	100 mm @ 26°C
1,4-Dioxane $OCH_2CH_2OCH_2CH_2$	Stable, colorless liquid; Ethereal odor;	65°F	40 mm @ 25°C
Phenol C_6H_5OH	Liquid; Sweet odor;	172.4°F	1×10^{-2} @ 20°C
Carbon Tetrachloride CCl_4	Colorless liquid; Heavy ethereal odor;	(c)	100 mm @ 23°C
Cresol $CH_3C_6H_4OH$	Colorless, yellowish or pinkish liquid; Phenolic odor;	180°F	1 mm @ 38-53°C
Cellosolve Solvent $C_4H_{10}O_2$	Colorless Liquid; Practically odorless;	108°F	3.8 mm @ 20°C
Cellosolve Acetate $C_6H_{12}O_3$	Colorless liquid; Ester-like odor;	117°F	2 mm @ 20°C
Tributyl Phosphate $(C_4H_9)_3PO_4$	Stable, colorless, odorless liquid;	295°F	(a)
Chlorobenzene C_6H_5Cl	Colorless liquid; Clear; Aromatic odor;	85°F	10 mm @ 22°C

TABLE C1-3. (concluded)

Sheet 3 of 3

CONSTITUENT & CHEMICAL FORMULA	DESCRIPTION	FLASH POINT	VAPOR PRESSURE (mm Hg)
Dichlorobenzene (Ortho) $C_6H_4Cl_2$	Colorless liquid; Pleasant odor	151°F	(a)
Trichlorofluoromethane CCl_3F	Liquid @ temps below 24°C; Faint ethereal odor	(a)	(a)
1,1,2-Trichloro-1,2,2-Trifluoroethane $C_2Cl_3F_3$	Colorless nearly odorless liquid	(a)	(a)
Nitrobenzene $C_6H_5NO_2$	Oily, pale to dark yellow or brown liquid; Characteristic odor of almond oil.	190°F	1 mm @ 44°C
Carbon Disulfide CS_2	Clear, colorless to faint yellow liquid; Strong disagreeable odor	-22°F	400 mm @ 28°C
Pyridine $CH<(CHCH)_2>N$	Colorless, liquid with sharp, penetrating, empyreumatic odor	68°F	10 mm @ 13.2°C

- (a) None listed in the Merck Index(1983), Dangerous Properties of Industrial Materials(6th Edition) or Hawley's Condensed Chemical Dictionary(11th Edition)
- (b) Autoignition temperature
- (c) None - as stated in Dangerous Properties of Industrial Materials(6th Edition) and/or Hawley's Condensed Chemical Dictionary(11th Edition)

C2.0 WASTE ANALYSIS PLAN

40 CFR 270.14(b)(3), 264.13(b) & (c)

WAC 173-303-806(4)(a)(iii), 300(5)

The Chemical Processors, Inc. Pier 91 Facility Waste Analysis Plan summarizes the facility, the wastestreams and the treatment processes. This plan also describes sampling methods, analytical parameters and rationale, quality control and assurance procedures, requirements for incoming wastes, storage requirements for ignitable, reactive and incompatible wastes and the waste tracking and record keeping procedures. The purpose of this plan is to describe the analytical methodologies used to characterize wastes to ensure safe and appropriate treatment, storage and disposal of dangerous wastes.

C2.1 Facility Description

Revised, December 1990, July 1991, November 1991

USEPA/Ecology Facility Identification Number: WAD000812917

Operator's Name: Chemical Processors, Inc.
Address: 2203 Airport Way South, Suite 400
Seattle, Washington 98134
Telephone Number: (206) 223-0500

Plant Name: Chemical Processors, Inc.
Pier 91 Facility
Address: 2001 West Garfield Street
Pier 91, Port of Seattle
Seattle, Washington 98119
Telephone Number: (206) 284-2450

The Chemical Processors, Inc. Pier 91 Facility is located at 2001 West Garfield Street, Pier 91 in the Port of Seattle, King County, Washington. Land use for the facility is

permitted and zoned by the City of Seattle as General Industrial Zone 1, with a 45' height limit (IG1 U/45).

The Pier 91 Facility is a 4-acre site used by Chemical Processors, Inc. for waste oil recovery and blending and for tank storage and treatment of dangerous wastes. The dangerous waste (RCRA-regulated) area (a 0.5 acre portion) includes a tank system with adequate secondary containment and a centrifuge. The proposed dangerous waste area (a 0.2 acre portion) will consist of a load/unload pump area with adequate secondary containment, a contained truck loading/unloading pad and a container storage area for temporary (90 day) storage of sludges generated on site.

Typical wastestreams processed at the Pier 91 Facility include oil and coolant emulsions, industrial wastewaters including alkalis, and industrial waste sludges. Contaminants in the wastestreams may include phenolics, metals, and solvents. In general, these wastestreams are treated in tanks by oxidation, reduction, demulsification, precipitation, neutralization, and heat treatment processes.

Table C2-1 displays the capacities and uses of the tanks at the site. Operations are discussed in detail in Section B, Facility Description and Section D, Process Information.

TABLE C2-1. WASTE STORAGE AND TREATMENT TANKS
Revised, Jan 1990, Jul 1990, Sep 1990, Dec 1990, Jul 1991, Nov. 1991

TANK NO.	TANK NAME/USAGE	STATUS	WORKING VOLUME (GAL) PER TANK	TOTAL VOLUME (GAL) PER TANK
2307, 2308, 2309, 2310	Heated Treatment/ Storage	Planned	14,100 ea.	14,810 ea.
2313	Heated Treatment/ Storage	Existing (Formerly tank 164)	14,100	14,810
2501	Treatment Chemical/ Storage (not RCRA- regulated)	Existing	5,287	5,874 ⁽¹⁾
2701, 2705, 2707	Industrial Waste Water Treatment/ Storage	Existing (Formerly tanks 105, 109, & 111)	44,657 ea.	49,485 ea.
2702, 2704	Industrial Waste Water Treatment/ Storage	Planned	91,727 ea.	96,555 ea.
2703 2708	Waste Oil Treatment/ Storage Tank	Existing (Formerly tanks 107, 112)	44,657 ea.	49,485 ea.
2706	Oil/Coolant Treatment and Storage	Existing (Formerly tank 110)	44,657	49,485
2709, 2710	Waste Oil Storage	Planned	52,832 ea.	55,940 ea.

EXISTING TANK STORAGE CAPACITY = 311,720 GAL
PLANNED TANK STORAGE CAPACITY = 364,230 GAL

TOTAL TANK STORAGE CAPACITY (S02) = 675,950 GAL

(1) Tank capacity not included in total for maximum waste inventory for reason indicated in parentheses.

C2.2 Identification of Wastes and Restricted Wastes
Revised, January 1990, December 1990, November 1991

Any waste listed in the Pier 91 Facility Part A Application could be accepted for treatment or storage. Refer to Section C1.1, Waste Characteristics, for detailed descriptions of the wastestreams handled at the Pier 91 Facility. For the purpose of describing the facility's treatment processes described in Section B, the wastestreams are divided into the following categories:

- Oil and Coolant Emulsions
- Industrial Wastewaters including Alkalies
- Industrial Waste Sludges

Any wastes not permitted in the Facility Part A Application are restricted from the Chemical Processors, Inc. Pier 91 Facility. Any waste with a flash point less than 100°F is not unloaded; the generator is notified, and the waste is either returned to the generator or sent to an off-site RCRA-permitted facility. In addition, the waste types described below are restricted from storage or treatment at the facility.

Radioactive Wastes - WAC 402-12-050 (49) (50):

49. "Radioactive material" means any material (solid, liquid, or gas) which emits radiation spontaneously.

Note: 49 CFR 17.389 defines radioactive material as a material or combination of materials that spontaneously emits ionizing radiation and having a specific activity greater than 0.002 (microCuries) uCi/gm.

50. "Radioactive waste" means any radioactive material which is no longer of use and intended for disposal or treatment for the purpose of disposal.

Reactive Wastes - WAC 173-303-090(7)(a)(i)-(viii):

(a) A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

- i. It is normally unstable and readily undergoes violent change without detonating.
- ii. It reacts violently with water.
- iii. It forms potentially explosive mixtures with water.
- iv. When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.
- v. It is a sulfide or cyanide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.
- vi. It is capable of detonation or explosive reaction if it is subject to a strong initiating source or if heated under confinement.
- vii. It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.
- viii. It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53, or a Class B explosive as defined in 49 CFR 173.88.

Infectious Wastes - 40 CFR 241.101(h)

"Infectious waste" means (1) Equipment, instruments, utensils, and fomites (any substance that may harbor or transmit pathogenic organisms) of a disposable nature from the rooms of patients who are suspected to have or have been diagnosed as having a communicable disease and must, therefore, be isolated as required by public health agencies; (2) laboratory wastes, such as pathological specimens (e.g. all tissues, specimens of blood elements, excreta, and secretions obtained from patients or laboratory animals) and disposable fomites (defined above) attendant thereto; (3) surgical operating room pathologic specimens and disposable fomites attendant thereto and similar disposable materials from out-patient areas and emergency rooms.

C2.3 Process Descriptions

Revised, July 1990

This section summarizes the treatment processes at the facility. Treatment processes and equipment are described in detail in Section B and in Section D, respectively.

Treatment processes at the facility include the following:

- Heat Treatment
- Chemical Oxidation
- Chemical Precipitation
- Chemical Reduction
- Neutralization
- Dewatering
- Centrifugation
- Clarification
- Decanting

- Flocculation
- Sedimentation
- Demulsification

Emulsified wastestreams are demulsified using the most appropriate combination of treatments based on the results of the Trial Treatment. Refer to Section C2.4, Sampling and Analytical Methodology. These treatments include heat treatment, chemical precipitation, dewatering, clarification and flocculation.

Phenolic wastestreams undergo chemical oxidation and heat treatment. Metal contaminated wastes are treated using chemical precipitation. Any hexavalent chromium that is present is reduced to the trivalent state using chemical reduction. The supernatant is then discharged to the sewer if it meets the discharge parameter limits. Precipitates from these treatment processes are handled as sludge, described below.

Sludges and semi-solids are consolidated and then transported to an off-site, RCRA - permitted facility, or they are processed through the centrifuge prior to off-site disposal. The liquid or filtrate is analyzed and treated, using one of the methods described above, based on the analytical results.

C2.4 Sampling and Analytical Methodology

40 CFR 264.13(b)(3), Part 261, Appendix I
WAC 173-303-300(5)(c), 110(2)

The Chemical Processors, Inc. sampling and analysis program is designed to obtain representative information used to evaluate a waste. A representative sample of a material is analyzed to:

- Verify generator supplied wastestream information on manifests and/or waste profile sheets;
- Determine safe and appropriate treatment or disposal processes based on waste characteristics; and
- Determine treatment process control information.

C2.4.1 Sampling Methods and Equipment

Revised, December 1990

Chemical Processors, Inc. uses principles of sampling methods presented in SW-846 (Test Methods for Evaluating Solid Waste, November 1986) and ASTM Methods (American Society for Testing Materials).

The sampling devices are selected according to size and type of container and the specific material involved. The sampling methods and equipment used for the various materials and containment vessels are presented in Table C2-2, Sampling Methods and Equipment. Sampling equipment is rinsed or disposed of between successive sampling of vessels to avoid contamination.

Samples are stored in containers that are compatible with the sampled material. All samples are stored in glass or plastic containers, except solvents or solvent contaminated materials which are stored in glass or metal containers only. Solid samples and oils can be stored in glass, plastic or metal containers. Containers are liquid-tight and range in size from 100 ml to 1,000 ml. Sample/container compatibility is summarized in Table C2-3.

TABLE C2-2. SAMPLING METHODS AND EQUIPMENT

WASTE TYPE	EQUIPMENT TYPES		METHOD REFERENCE SW846 ^(a) / ASTM ^(b)
	CONTAINMENT DRUM/CONTAINER	VESSEL TANK(ER)	
Free flowing liquids and slurries	-Glass/PVC Tube -Coliwasa	-Weighted bottle	1.2.1.1/D4057-81
		-Dipper	1.2.1.2
		-Glass/PVC Tube	1.2.1.3
		-Coliwasa	
Sludges	-Glass/PVC Tube -Trier	-Dipper	1.2.1.3/D4057-81
		-Trier	1.2.1.5
		-Metallic tube	
Extremely viscous liquid/sludge	-Scoop -Auger -Metallic tube	-Shovel	1.2.1.7/D140-70
		-Scoop	1.2.1.6
		-Metallic tube	
		-Auger	
Soil-like and packed solids	-Auger -Metallic tube -Trier	-Trier	1.2.1.7/D1452-65
		-Metallic tube	1.2.1.6
		-Shovel	1.2.1.5
		-Scoop -Auger	
Solids (impervious)	-Auger -Knife -Saw	-N/A	

(a) SW 846-U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Waste, July 1982. Office of Water and Waste Management, Washington, D.C.

(b) ASTM-American Society for Testing Materials. Annual Book of ASTM Standards, Philadelphia, PA.

TABLE C2-3. SAMPLE/CONTAINER COMPATIBILITY

<u>Sample</u>	<u>Container</u>		
	<u>Plastic</u>	<u>Glass</u>	<u>Metal</u>
Bases	*	*	
Solvents		*	*
Oils	*	*	*
Solids	*	*	*
Aqueous	*	*	

* Sample compatible for storage in this type of container.

C2.4.2 Frequency of Sampling and Analysis

Revised, May 1991

40 CFR 264.13(b)(4)

WAC 173-303-300(5)(d)

Each tank truck is sampled prior to off-loading the waste. Storage and treatment tanks are sampled prior to and/or during treatment, consolidation, transfer of materials, and discharge to the sewer. Prior to treatment, consolidation, blending, and/or transfer a representative sample is obtained using an appropriate sampling device or samples may be obtained from the circulating lines or sampling spouts on each tank. During treatment, consolidation or transfer, representative samples are obtained from the circulating lines or sampling spouts, as needed. The discharge tanks are sampled as required by the Municipality of Metropolitan

Seattle (Metro) Industrial Wastewater Discharge Permit for the Chemical Processors, Inc. Pier 91 Facility.

Wastes which will be blended into dangerous waste-derived fuels that are destined for energy recovery in industrial boilers or furnaces which have not certified compliance in accordance with 40 CFR Part 261.103 will contain at least 5,000 Btu/lb, except when a material can be demonstrated to be burned "Solely as an Ingredient".

Solids and semi-solids are sampled as the disposal vessels are being filled, or by collection of a composite sample from approximately 10% of the containers of solids ready for disposal.

C2.4.3 Sampling Procedures

Sampling is performed at the Chemical Processors, Inc. Pier 91 Facility by personnel who are properly trained in representative sampling methodology. Refer to Section H, Personnel Training, for a detailed description of the facility training plan. Sampling of a waste is also performed by the customer at the generating location. Customers (generators) must certify that they have obtained a representative sample of the waste material for incoming waste pre-acceptance. Chemical Processors, Inc. refers customers to WAC 173-303-110(2) and 40 CFR 264.13(b)(5) for guidance on representative sampling methodology.

Sampling is performed to ensure a representative sample is obtained. Depending on the nature of the waste material and the feasibility of obtaining a sample, a top-to-bottom sample is generally obtained from a container. Grab samples from different layers are obtained from tanks or tank trucks. The sampling equipment and methods used are described in Section C2.4.1, Sampling Methods and Equipment.

Samples are placed in appropriate containers and labeled with a standardized label. They are preserved, if necessary (refer to Section C2.5, Quality Assurance and Quality Control), and taken to the appropriate sample storage location in the laboratory for analysis. All samples are logged in a sample check-in book located in the laboratory. Final disposition of samples, after analyses are complete, is determined by the most suitable treatment process for that sample. For example, a waste coolant sample would be returned to an oil and coolant emulsion storage tank.

C2.4.4 Analytical Rationale and Parameters

Revised, January 1990, May 1991, July 1991

40 CFR 264.13(b)(1)

WAC 173-303-300(5)(a)

This section describes the parameters for analysis and the rationale for selecting these parameters. Samples are analyzed to:

- Verify generator-supplied wastestream information
- Confirm pre-existing waste characterization
- Determine the treatment or disposal process applicable to waste characteristics
- Comply with facility acceptance criteria
- Define operational parameters for various treatment processes.

Analytical methods are classified as primary and secondary analyses. These analyses provide a general identification and characterization of the wastestream. All wastes are subjected to the appropriate primary analyses. The secondary analyses augment the primary screening. These analyses are selected according to need based on the results of the primary analyses, process tolerance limits and

specific waste characteristics. The results of the secondary analyses provide another level of confidence regarding waste characterization, identification and proper storage and treatment. The parameters for analysis and the rationale for selecting these parameters may change as analytical methodology improves, waste characteristics change or regulatory requirements change.

Primary Analyses and Rationale for Selection

Primary analyses are analytical procedures designed to identify or screen specific waste components. They have been developed based upon operating experience as a quick, but effective, means for establishing acceptance and processing decisions pertinent to proper waste management.

The primary analyses include 14 basic screening procedures that provide a general identification or characterization of the waste. They indicate an immediate discrepancy in sampling or generator supplied information. The results of primary screening help determine the most suitable treatment process and indicate pre-treatment requirements. They are also used to determine appropriate secondary analyses. The parameters and associated rationale for these primary analyses are as follows:

1) Physical Description

A Physical Description determines the general characteristics of the waste. This parameter facilitates subjective comparison of the sampled waste with prior waste descriptions or samples. The physical description applies to all wastestreams.

2) pH Analysis

Analysis for pH determines the corrosive nature of the waste. This test applies to aqueous or water soluble wastes.

3) Water Mix Screen

The Water Mix Screen determines the waste's solubility or reactivity in water. The extent of solubility in water helps determine appropriate treatment and helps verify specific gravity (i.e. if the waste is heavier or lighter than water). The Water Mix Screen can also indicate the presence of oils or solvents. Testing for reactivity in water determines whether a waste has the potential to react vigorously with water forming visible gases, precipitates or generating significant heat. This test does not apply to wastestreams with high water content.

4) Ignitability Screen

The Ignitability Screen indicates how easily a waste will ignite. This test applies to waste liquids, solids or semi-solids and is used if other information indicates the waste is ignitable (for example, a waste which is physically described as oily or layered).

5) Hexavalent Chromium (Cr+6) Spot Test

The Hexavalent Chromium Spot Test determines the presence of hexavalent chromium in a waste. It applies to aqueous wastestreams to determine the need for pre-treatment.

6) Phenolics Spot Test

The Phenolics Spot Test determines the presence of phenolics. Although phenolics are easily detected by odor, this test provides another level of confidence regarding appropriate treatment. This test applies to aqueous wastestreams and organic samples which are suspected of containing phenolics.

7) Cyanide Spot Test

The Cyanide Spot Test determines the presence of free (or simple) cyanide that would be potentially reactive under acid conditions. This test applies to aqueous samples of pH above 2. This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System).

8) Treatability Test

This test is a simulation of the Chemical Processors, Inc. Tacoma Facility treatment processes. This test determines the most suitable treatment process for an incoming waste. This test is also used to indicate how much sludge will be generated during treatment. The test applies to aqueous wastestreams destined for treatment at Tacoma. It is used when pre-screening wastes for waste profile review (see Section C2.6.1, Waste Profile System).

9) Chlorinated Solvent Screen-Beilstein Test

The Chlorinated Solvent Screen applies to organic wastes and aqueous wastes with organic contaminants. This test indicates the presence of chlorine in wastes.

10) Test for Reactive Sulfide

The test for reactive sulfide determines the presence of reactive sulfide in a wastestream. This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System).

It is applied to alkaline or neutral aqueous wastestreams, wastewaters and wastewater sludges, oils and oil sludges, paints and paint sludges, soils, aluminum chemical milling waste and any waste profiled as containing sulfide. It does not apply to acid wastes because sulfide does not exist under acid conditions.

11) Compatibility Determination Procedures

These procedures are used to determine the compatibility of wastestreams prior to storage, consolidation and treatment.

12) Trial Treatment

This method is a simulation of the treatment processes used at the Pier for demulsification. It applies to emulsified wastes. This test is also used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System) and prior to treatment.

13) Radioactivity Test

The radioactivity test screens for the presence of radioactive constituents in a waste. This test applies to all wastestreams that are suspected of radioactivity or have been potentially subjected to radioactivity.

14) PCB Analysis

PCB analysis identifies and quantifies the presence of polychlorinated biphenyl (PCB) in a waste. This test may apply to oily liquid or solid waste, solvents, fuels, alkaline wastes, and paint wastes.

Secondary Analyses and Rationale for Selection

Secondary analyses are performed to further characterize the wastes and provide quantitative back-up to the primary analyses. These tests provide additional information regarding the proper means of storage, treatment and disposal. The determination of whether or not any of these tests are to be performed is based on the results of the primary analyses, suspect contamination, and the need to further characterize wastes for specific treatment or disposal methods. Some of these methods are performed by an outside laboratory. The specification of an outside

laboratory is discussed in Section C2.5.3, Selection/ Specification of an Outside Laboratory. The following is a list of secondary analyses which may be performed. The associated rationale is also identified.

In accordance with the requirements of 40 CFR 268.7(b) and (c) and 264.13(a)(2), the Pier 91 Facility will conduct periodic physical and chemical analysis on wastestreams to assure that the appropriate Part 268 treatment standards are met. In addition to analyses conducted by Chempro, the facility will also use information provided by the generator.

The generator requirements as specified in 40 CFR 268.7 will accompany each shipment of waste to a treatment facility and to a land disposal facility. All required certifications specified in 40 CFR 268.7 will be provided.

1) Phenolics Total Recoverable

This test quantifies the concentration of phenolic material in a waste. The test provides qualitative analysis for wastestreams which when tested, produce a positive result to the primary phenol screen. It also provides quantitative analysis to ensure that the phenol level of the final water samples meets the sewer discharge limits.

2) Metals by Atomic Absorption

Metals by Atomic Absorption Analyses quantify the concentration of specified metals in a wastestream. This test may be performed at various steps during the treatment process to determine treatment requirements, and is also performed on treated wastewater prior to discharge to the sewer.

3) Sulfide Quantitative Analyses

The Sulfide Quantitative Analysis quantifies the total sulfide concentration. It provides quantitative back-up to the sulfide spot test. The test applies to wastes that show a positive response to the sulfide spot test and to metal and sulfide-bearing wastestreams. This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles and for profiling wastes for off-site disposal (see Section C2.6.1, Waste Profile System).

4) Specific Gravity (Density)

Specific Gravity (Density) is the ratio of the mass of a volume of sample to the mass of an equal volume of distilled water. It applies to incoming tanker loads to determine proper storage methods, specification of oil and for solvent screen test data. This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System).

5) Cyanide Quantitative Analyses

These analyses quantify the concentration of free and total cyanide present. The cyanide colorimetric method and the cyanide titrimetric method are used to quantify free cyanide. A cyanide distillation is done as preparation for quantification of total cyanide by the colorimetric and/or titrimetric methods. After distillation total cyanide can be quantified. These methods apply to treated wastewater prior to sewer discharge, to wastes containing cyanide based on the colorimetric spot test and to solids (to which the colorimetric spot test cannot be applied). This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System).

6) PCB Analysis

PCB Analysis identifies and quantifies the presence of polychlorinated biphenyls in a waste. The test applies to oily liquid or solid waste, solvents, fuels, alkaline wastes and paint waste. This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System).

7) Oil and Grease

The test for Oil and Grease quantifies the amount of dissolved or emulsified oil and grease present in treated wastewater prior to discharge to the sewer.

8) Settleable Solids (SS)

The test for Settleable Solids quantifies the amount of settleable solids present in treated liquid wastestreams after settling, and prior to decanting or discharging treated wastewater to the sewer.

9) EP Toxicity

The test for EP Toxicity determines whether an extract of a waste contains toxic contaminants as defined by WAC 173-303-090(8)(c). This applies to wastes as required by the ultimate disposal site.

10) Flash Point

The Flash Point Test must be used in order to determine whether the waste exhibits the characteristic of ignitability. The flash point further characterizes flammable or combustible wastes to establish proper storage modes and conformance to permit conditions.

11) GC-MS Volatile Solvent Analysis (Solvent Scan)

The GC-MS Volatile Solvent Analysis identifies the chlorinated solvents present in oily wastes. This test

applies to wastes containing solvents based on the screens for solvents included in the primary analyses.

12) Total Toxic Organics (TTO)

This analysis quantifies the level of TTO in treated wastewater prior to discharge to the sewer.

13) F-List and Solvent Analysis (F-List Solvent)

This analysis applies to solid or semi-solid wastes going to an off-site, authorized dangerous waste landfill. It quantifies and identifies F-Listed solvents (WAC 173-303-9904). This test is used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles (see Section C2.6.1, Waste Profile System).

14) Proposed ASTM Test Method for Total Chlorine in Used Oil by Oxidative Combustion and Microcoulometry

This analysis applies to organic materials which are suspected of containing chlorinated solvents. It quantifies total chlorine in wastes.

15) British Thermal Unit (Btu) Value

This analysis applies to dangerous waste fuels. It is used to determine the heating value of fuels.

16) Test for Chlorine in New and Used Petroleum (Oxygen Bomb Combustion Method)

This analysis applies to organic materials which are suspected of containing chlorinated solvents. It quantifies total chlorine in wastes and in dangerous waste fuels.

17) Determination of Solids

This analysis is done to determine successful demulsification of wastes with a minimum generation of

solids. This test is also used to pre-screen acceptability of wastes at the Pier 91 Facility when reviewing waste profiles.

18) Pentachlorophenol Analysis

This method is used to determine the presence of tri, tetra or pentachlorophenol compounds in a wastestream. It applies to wastes suspected of containing these compounds based on generation point, e.g. wood products industry.

19) Paint Filter Liquids Test

This method is used to determine the presence of free liquids in containerized material destined for container storage.

20) Toxicity Characteristic Leaching Procedure (TCLP)

The TCLP determines the mobility of organic and inorganic contaminants present in wastes. It applies to wastes specifically banned from land disposal and determines whether the waste meets Best Developed Available Technology (BDAT) treatment standards.

The TCLP will be used to assess the toxicity of applicable characteristic wastes starting on September 25, 1990. TCLP is also the protocol used to determine if treatment to a standard has been achieved.

The TCLP is used as a means of measuring compliance with the metal standards for toxic characteristic wastes of the Third Third land disposal restriction rule (Federal Register/Vol. 55 No. 106/Friday, June 1, 1990). There are two exceptions as follows:

- Nonwastewater characteristic for lead;
- Nonwastewater with arsenic as primary constituent (D004, K031, K084, K101, K102, P010, P011, P012, P036, P038 and U136).

If these above wastes achieve a standard based on an EP extract analysis then the waste is in compliance with the standard.

TCLP will be conducted by Chemical Processors, Inc. using the procedure outlined in Appendix I to Part 268 - Toxicity Characteristic Leaching Procedure (TCLP), Federal Register/Vol. 51 No. 216/Friday, November 7, 1986/Rules and Regulations.

C2.4.5 Analytical Test Methods

Revised, January 1990

40 CFR 264.13(b)(2)

WAC 173-303-300(5)(b)

The test methods used for measuring the analytical parameters are described in this section. Specific test methods for wastes treated and stored at the Chemical Processors, Inc. Pier 91 Facility are grouped according to primary and secondary analyses. Some of the analytical methods for each waste parameter are selected from available technical methods described in the following publications (or latest edition):

1. "Standard Methods for the Examination of Water and Waste Water," 16th Edition, American Public Health Association.

2. "Test Methods for Evaluating Solid Waste," SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986.

3. "A Method for Determining the Compatibility of Hazardous Wastes," EPA-600/2-80-076, April 1980.

4. "1986 Annual Book of ASTM Standards," American Testing Society for Testing Materials, 1916 Race Street, Philadelphia, PA 19103.
5. "Design and Development of a Hazardous Waste Reactivity Testing Protocol" EPA-600/2-84-057, 1984.
6. "Prudent Practices for Disposal of Chemicals From Laboratories" National Academy of Sciences, National Academy Press, 1983.
7. "Handbook of Analytical Chemistry" Mites, Lewis, McGraw Hill Book Company, 1963.
8. "EPA Methods for Chemical Analysis of Water and Wastes", EPA-600/400-79-020, March 1983.
9. "Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulation", WDOE 83-13, March 1982 (revised July 1983 and March 1984).

Any standard analytical methods used by Chemical Processors, Inc. are referenced in Appendix C-2, Analytical Test Methods, but are not included completely. Modifications of standard methods and Chemical Processor designed analytical methods are also included in Appendix C-2. Methods used by the Chemical Processors, Inc. Corporate Laboratory will be updated and modified to reflect changing regulatory requirements, standard methods or equipment.

C2.5 Quality Assurance and Quality Control

The Chemical Processors, Inc. Corporate Laboratory Quality Assurance program measures precision and accuracy in analyzing wastestreams. Quality assurance and quality control (QA/QC) procedures are applicable to both sampling

and analytical procedures. The Technical Director has overall responsibility for the QA/QC program.

The purpose of the QA/QC program is to:

- assess the accuracy and precision of the data generated by the laboratory
- permanently record laboratory performance and results
- measure the accuracy and precision of analytical methods and equipment.

C2.5.1 Sampling Techniques: QA/QC

Revised, January 1990

Quality assurance and quality control in relation to sampling consists of using the following components:

1. Representative sampling methods as defined by WAC 173-303-110(2)
2. Appropriate sample containers and equipment
3. Standard labeling procedures
4. Consistent procedures for receiving samples at the laboratory
5. Adequate preservation of samples prior to analysis
6. Chain of custody procedures.

Sampling is performed to ensure a representative sample of the waste is collected. Specific methods are described in Section C2.4.1, Sampling Methods and Equipment. Methods are selected based on the material and the container type. Only trained personnel perform the sampling.

Containers and equipment are selected to prevent contamination or degradation of the sample and to ensure compatibility of the waste with the equipment and container used. In addition, equipment is cleaned and triple-rinsed or disposed of between the collection of consecutive samples

to avoid sample contamination. A standard sample label (refer to Appendix C-4) is applied to all sample containers at the time of sampling. Each sample is labeled with the following information, when applicable:

- Date and time sample collected*
- Name of sampler*
- Sample description
- Generator name*
- Source of sample*
- Analysis requested
- Date needed for analysis results
- Waste tracking number, Waste Profile Sheets number, Manifest number, and Waste Code
- Lab Sample number (filled in by Lab)*

*Information required as necessary to prevent misidentification of samples per EPA test methods or evaluating solid waste, SW 846.

All samples received in the laboratory are recorded in a log book. The following information, when applicable is documented for each sample received in the lab:

- Name of person checking sample into lab
- Date/time*
- Sample tracking number
- Lab sample number*
- Sample source and description (Generator, vessel, etc.)*
- Analytical parameters
- Outside lab, if applicable
- Date sent to outside lab
- Date requested for analytical results
- Date analytical results completed

*Information required as necessary to prevent misidentification of samples per EPA Test Methods for Evaluating Solid Waste, SW 846.

Samples are preserved to avoid deterioration. Methods of preservation are selected for the waste constituent of interest. Methods of preservation are discussed in the standard methods referenced for each of the secondary analyses. Methods of preservation are also described in the Standard Methods for the Examination of Water and Waste Water (Table 105:I) reference. The following examples for the preservation techniques reference this table.

Examples of Sample Preservatives

<u>Analytical Test</u>	<u>Sample Preservation Technique</u>
TTO	Refrigeration
Oil and Grease	Hydrochloric Acid to pH<2
F Listed Solvents	Refrigeration
Metals	Nitric Acid to pH<2

C2.5.2 Analytical Methods and Results: QA/QC

Revised, December 1990, May 1991

The Chemical Processors, Inc. Corporate Laboratory is accredited under the Washington State Department of Ecology Laboratory Accreditation Program. The Pier 91 Facility uses either the Corporate Laboratory or another Washington State accredited laboratory for discharge monitoring analyses.

Chemical Processors, Inc. typically uses standard analytical methods recommended by the EPA and ASTM. Some of these methods have been modified to meet our specific waste characterization needs. These modifications are made based

on experience and comparative testing. Analytical methods are described in Section C2.4.5, Analytical Test Methods. Laboratory personnel refer to the published standard methods found in SW-846 for specific quality control procedures such as reagent stability, analysis of blanks, standards, spikes and method calibration.

Reagents and standard stock solutions are made often and in small quantities, and are stored in appropriate containers and conditions to ensure quality. They are also checked regularly for signs of deterioration such as formation of precipitates, discoloration and change in concentration.

All testing equipment is routinely cleaned, inspected, and maintained. Service is performed as needed based on performance. Equipment is also calibrated to within acceptable limits according to EPA or manufacturer specifications.

The laboratory performs regular analyses of Quality Control (QC) samples which include instrument check standards, reference standards, water and reagent blanks, duplicate and spiked samples and split samples. These results determine the accuracy and precision of the analytical methods, instruments and the operators. Specific Quality Control requirements for the frequency of QC sample analyses are described in Appendix C-2, Analytical Methods, and C-3, Quality Assurance/Quality Control.

All quality control data and records are kept in notebooks at the Chemical Processors, Inc. Corporate Laboratory for a minimum of 3 years.

A general Quality Assurance Program Plan for analytical methods used at the Chemical Processors, Inc. Corporate

Laboratory is included in Appendix C-3, Quality Assurance/Quality Control.

C2.5.3 Selection/Specification of an Outside Laboratory

Revised, May 1991

Some analyses are beyond the scope of the Chemical Processors, Inc. Laboratory at this time. Outside laboratories are selected to do the analyses at this point. Outside labs are contracted based on the laboratory's:

- Capability of performing the required analyses
- Response time
- Reliability
- Precision and accuracy of data generated

Current plans for the Chemical Processors, Inc. Corporate Laboratory include the capability to do all required analyses in-house. This includes, but is not limited to, purchasing the following laboratory equipment:

- Gas Chromatograph/Mass Spectrometer for F-List Solvent Analysis, TTO and organic analysis by EPA-approved protocol.
- Inductively Coupled Plasma Spectrometer for analysis of metals by EPA-approved protocol.

Analytical methods used for these analyses will be selected from standard references and will be based on regulatory requirements.

C2.5.4 Chain of Custody Procedures

Revised, January 1990

Customer (generator) supplied samples received at the laboratory must be accompanied by a chain of custody form attached to the waste profile sheet. An example of this form is found in Appendix C-4, Waste Tracking Forms. These samples are recorded in a logbook and tracked by a unique Lab Sample number as described below.

Chain of custody for samples from the Chemical Processors, Inc. treatment facilities consists of standard labeling and laboratory check-in procedures. Labels are applied to sample containers at the time of sampling. Each sample is labeled as described previously in Section C2.5.1. All samples received in the laboratory are recorded in a log book. They are given a unique sequential Lab Sample Number. The information described previously in Section C2.5.1 is documented for each sample received.

C2.6 Requirements for Incoming Wastes

40 CFR 264.13(c)

WAC 173-303-300(5)(g)

The Chemical Processors, Inc. Pier 91 Facility obtains a detailed chemical, physical and/or biological analysis of each waste before it is stored, treated or disposed. This is done for wastes received from off site by means of the waste profile system and/or incoming waste analyses.

C2.6.1 Waste Profile System

Revised, January 1990

The waste profile sheet contains information which a potential customer provides. Chemical Processors, Inc. uses

the information to determine if the waste can be accepted for storage or treatment operations conducted at the Pier 91 Facility. Approval of a waste profile is dependent on existing permits and operational constraints.

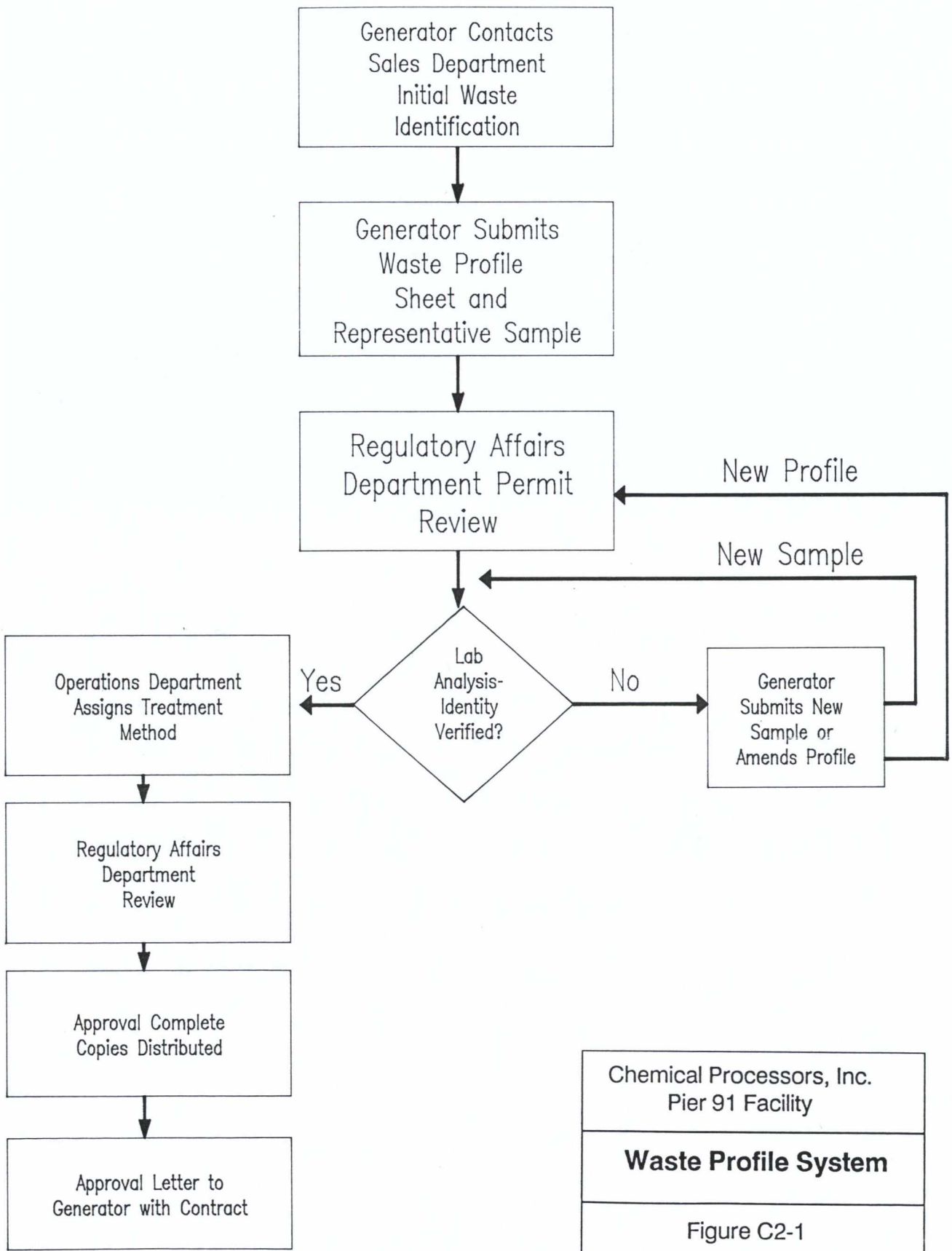
Figure C2-1, Waste Profile System, outlines the procedures involved in waste profiling. The forms used to document the information obtained in the waste profile system are in Appendix C-4, Waste Tracking Forms. The procedure for the completion of a waste profile sheet is as follows:

- 1) A generator contacts the Sales Department for information regarding a specific waste. After a brief interview, Sales sends the generator all forms and guidelines necessary to initiate the waste profile system.

- 2) The generator receives the waste profile sheet and is instructed to complete each section (where applicable). Chemical Processors, Inc. Sales, Operations, Laboratory and/or Regulatory Affairs Departments can assist the generator in completing the waste profile sheet. As a service to the generator, Chemical Processors, Inc. may analyze representative samples of the wastestreams and complete the profile form.

- 3) The generator submits the completed waste profile sheet and a representative sample. Exceptions for the submittal of a representative sample are described in Appendix C-5, Exceptions to the Waste Profile System Sample Submittal Requirement. The sample is stored in the Laboratory until the Regulatory Affairs Department reviews the waste profile sheet.

- 4) The Regulatory Affairs Department reviews the profile sheet to determine if Chemical Processors, Inc. is permitted to manage the waste. A form for documenting written approval is attached to the waste profile sheet.



5) When the initial review is complete, the waste sample is analyzed as described in Section C2.4, Sampling and Analytical Methodology. The Laboratory verifies the waste characteristic information on the waste profile sheet. The results of these analyses are attached to the waste profile sheet. The sample is also subjected to a trial treatment to determine acceptability for treatment at the Pier 91 Facility.

6a) If the analytical results verify the description given on the profile, the profile continues on to the Operations Department. Operations personnel review the waste profile sheet and assign a disposal method. Operations notes on the approval form any special handling or packaging requirements which are necessary to properly manage the waste.

6b) If the Laboratory determines that the sample does not represent the information on the waste profile sheet, the profile is rejected. Sales personnel contact the generator and either amend the profile or request a new sample.

7) The final approval step involves another review by Regulatory Affairs personnel. The waste profile sheet, analytical data and operational recommendations are reviewed for completeness, accuracy and compliance.

8) When the waste profile sheet is approved, copies are distributed to the receiving facility, the Chemical Processors, Inc. Sales Office and the generator.

9) The generator also receives an approval letter noting the required annual or bi-annual profile review (described below), the requirement to notify Chemical

Processors, Inc. of any process changes affecting the wastestream and a contract.

Chemical Processors, Inc. reviews all waste profiles on an annual or bi-annual basis. Customers (generators) are formally informed that they must notify Chemical Processors, Inc. of any change in the process generating the waste. In the event of a change in generating process, a new representative sample is submitted and the waste profile sheet and sample are reviewed as previously described.

A review of a waste profile also occurs when a shipment of a waste is determined to be unacceptable upon arrival at the facility (refer to Section C2.6.2, Waste Check-In Procedures), and if any abnormal event occurs at the facility during waste handling which may be attributed to the waste. An example of such an event may be the inability to successfully precipitate metals from the wastestream.

C2.6.2 Waste Check-In Procedure

Revised, January 1990, December 1990

The purpose of the Check-In Procedure is to confirm that the contents of each waste shipment match the identity of the waste as specified on the manifest. This is accomplished by the following steps:

- 1) A shipment arrives at the facility and is directed to the unloading area. Advance scheduling of each shipment is helpful.
- 2) The manifest, bill of lading and physical load are inspected to verify the following:

a) The correct volume of waste is indicated on the manifest.

b) The information on the manifest is correct.

Any discrepancies are managed according to the Problem Manifest Procedure presented in Appendix C-4, Waste Tracking Forms.

3) The wastes listed on the manifest are checked to ensure that the facility is permitted to handle that waste and that the waste has an approved profile for that generator.

4) The hazardous waste technician, record keeper or a supervisor completes a waste receipt form and attaches it to the manifest.

5) The hazardous waste technician receives a waste tracking number for each bulk waste shipment and records the number on the Input Log. Record keeping and waste tracking procedures are discussed in Section C2.8, Record Keeping and Waste Tracking.

6) Bulk wastes are sampled and analyzed prior to unloading. Refer to Section C2.4.4, Analytical Rationale and Parameters.

7) If the analyses verify the waste is properly represented, the waste is accepted and stored or processed. No waste will be processed until this verification is complete. If the analyses indicate there are significant variances from the profile or manifest, the sample is submitted to the Chemical Processors, Inc. Corporate or Facility Laboratory for further analyses.

8) If further analyses prove the waste does not match the generator's profile or the manifest description, the load is held in the transport vehicle while the generator is informed of the discrepancy and given the following options:

a) Amend the current profile or manifest, or submit a new profile which properly represents the waste.

b) Provide Chemical Processors, Inc. permission to transport the load back to the generator or to an alternate TSD facility.

9) When all discrepancies, if any, are resolved, the shipment is off-loaded in the designated loading/unloading area.

C2.7 Requirements for Ignitable, Reactive or Incompatible Wastes

Revised, January 1990, July 1990, December 1990,
November 1991

40 CFR 264.17

WAC 173-303-395(1)&(2)

Reactive, incompatible or ignitable wastes are identified by the analytical methods described in Section C2.4, Sampling and Analytical Methodology. In addition, manifests and waste profile sheets are used to identify these wastes. A general overview of special requirements for handling ignitable, reactive or incompatible wastes is in this section. For more information refer to Procedures to Prevent Hazards (Section F), Buffer Monitoring Zones (Section B) and Management of Ignitable, Reactive or Incompatible Wastes in Tanks and Containers (Section D).

Ignitable

Ignitable wastes with a flash point less than 100°F are not unloaded; the generator is notified, and the waste is either returned to the generator or sent to an off-site RCRA-permitted facility. Ignitable wastes with a flash point of 100-140°F

are stored in a bermed containment system. These storage areas are in compliance with National Fire Protection Association (NFPA) buffer zone requirements. A foam fire extinguishing system is manifolded to each tank throughout the facility for use in the event of a fire. Fire extinguishers are also located on site. The local fire department has a station located within 1 mile of the facility and is familiar with the layout of the facility including tank contents and container storage locations.

Reactive

Reactive wastes are controlled by restricting them from the Chemical Processors, Inc. Pier 91 Facility. Specifically those wastes defined by WAC 173-303-090(7) are not accepted.

Incompatible

Incompatible wastes are segregated prior to storage. The segregation of incompatible wastes is based on the Department Of Transportation (DOT) hazard classes and "The ASTM Proposed Guide for Estimating the Incompatibility of Selected Hazardous Wastes Based on Binary Chemical Reactions, D-34 Proposal P 134". Only compatible wastes are consolidated. The compatibility of wastes is determined by the procedures described in Section C2.4.5, Analytical Test Methods.

Wastestreams are verified for compatibility with the storage container by ensuring the container is a DOT specification

container and approved for the DOT classification of the waste. Wastes placed in unwashed containers are verified for compatibility with residues in that container by the procedures described in Section C2.4.5, Analytical Test Methods. If the wastes are incompatible with the residues in the container, the residues are removed from the containers (i.e. the containers are emptied as defined by Department of Transportation (DOT), EPA and DOE regulations).

Wastes destined for tank treatment or storage must be compatible with the tanks and the residues in the tanks. Storage and treatment tanks and the centrifuge are constructed of carbon steel. Tank systems are described in detail in Section D, Process Information. Before a tank can be used for a material which is incompatible with residue in the tank, the tank is decontaminated and the rinsate is disposed with the previous contents of the tank.

C2.8 Record Keeping and Waste Tracking

This section describes the facility record keeping procedures for waste analysis and handling and the waste tracking procedures for identifying each waste movement at the facility.

C2.8.1 Record Keeping

As required by WAC 173-303-210(3) all records of test results, waste analyses, or other determinations performed for the purpose of designating, treating, storing or disposing of dangerous waste are kept for at least 3 years.

Record keeping includes but is not limited to:

- Analytical Data from Analyses Performed In-House
- Results of Analyses Performed by Approved Outside Laboratories
- Incoming Waste Report Forms Used to Record Results of Primary Analyses of Incoming Wastes
- Chain of Custody Records
- Waste Receipt Forms
- Hazardous Waste Manifests and Bills of Lading
- Waste Profile Sheets
- Waste Profile Sheet Approval Forms
- Input Logs
- Waste Handling Logs
- Tank Change or Transfer Sheets
- Treatment Sheets

Examples of record keeping forms are in Appendix C-4, Waste Tracking Forms.

C2.8.2 Waste Tracking Procedures

As required by WAC 173-303-300(i) the procedures for identifying each waste movement at the facility are described in this section.

Wastes received from off site are shipped in bulk by tanker, and are recorded on a Waste Receipt Form. The unique sequential number printed on each Waste Receipt Form is the core of the waste tracking system at the Chemical Processors, Inc. Pier 91 Facility. Each waste load is given the unique Waste Receipt Number to track its progress through the facility. Specific details of waste tracking are described below.

Tracking of Wastes in Tanks

Wastes received at the facility are assigned a unique waste tracking number from the waste receipt form, as described above. The waste tracking number, the manifest number, generator, waste type and volume are recorded on the input log. When a waste is transferred from a tank the date, volume and waste description is recorded on the tank transfer sheet. Any laboratory analyses are recorded on the original waste receipt form. The type of treatment used to process the wastestream is recorded on the treatment sheet. Examples of waste tracking forms are in Appendix C-4, Waste Tracking Forms.

APPENDIX C-1
TYPICAL ANALYSIS OF WASTES

Refer to Table C1-1

Oil and Coolant Emulsions 1-16

Industrial Wastewaters 17-21

Industrial Waste Sludges 22

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 1

Color: Cloudy green water with floating oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: ~1.0

Flash Point: 140-200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <5	Cu: <10
Cr: <5	Ni: <5
Hg:	Zn: <20
Pb: <5	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <500

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 2

Color: Dirty grey/brown water with visible oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: ~1.0

Flash Point: >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <10
Cr: <1	Ni: <1
Hg:	Zn: <5
Pb: <5	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 3

Color: White to tan liquid with floating oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: ~1.0

Flash Point: >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <5
Cr: <5	Ni: <5
Hg:	Zn: <50
Pb: <5	Tl:
Cr+6: <5	

Others: ppm

CN:	PCB:
S:	Phenolics: <500

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 4

Color: Clear to dirty brown, grey or blue with floating oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: ~1.1

Flash Point: 140-200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd:<1	Cu: <2
Cr:<2	Ni: <2
Hg:	Zn: <25
Pb:<2	Tl:
Cr+6: <2	

Others: ppm

CN:	PCB:
S:	Phenolics: <5,000

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 5

Color: Grey, tan or brown liquid with bottom sediment and visible oil

Physical State: Liquid

Free Liquids: 100%

pH: 6-11

Specific Gravity: ~1.0

Flash Point: No Flash

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <2
Cr: <2	Ni: <2
Hg:	Zn: <10
Pb: <1	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <500

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 6

Color: Cloudy with visible oil

Physical State: Liquid

Free Liquids: 100%

pH: 5-10

Specific Gravity: ~1.0

Flash Point: No Flash

Metals: ppm

As:	Se:
Ba:	Ag:
Cd:<1	Cu: <2
Cr:<5	Ni: <2
Hg:	Zn: <5
Pb:<2	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <500

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 7

Color: Dirty water with yellow oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: .8-.9

Flash Point: 101-140°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <5
Cr: <5	Ni: <5
Hg:	Zn: <10
Pb: <5	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 8

Color: Dirty brown liquid with visible oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6.0

Specific Gravity: ~1.00

Flash Point: No Flash

Metals: ppm

As:	Se:
Ba:	Ag:
Cd:<1.0	Cu: <2.0
Cr:<2.0	Ni: <2.0
Hg:	Zn: <2.0
Pb:<2.0	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 9

Color: Grey liquid with visible oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6.0

Specific Gravity: ~1.0

Flash Point: No flash or $>200^{\circ}\text{F}$

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <5.0	Cu: <10
Cr: <5.0	Ni: <2.0
Hg:	Zn: <10
Pb: <2.0	Tl:
Cr+6: <1.0	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 10

Color: Cloudy grey with sediment

Physical State: Liquid

Free Liquids: 100%

pH: ~6.0

Specific Gravity: ~1.0

Flash Point: No flash or >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1.0	Cu: <1.0
Cr: <1.0	Ni: <1
Hg:	Zn: <5
Pb: <5.0	Tl:
Cr+6: <1.0	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 11

Color: Brown/grey with visible oil

Physical State: Liquid

Free Liquids: 100%

pH: ~6.0

Specific Gravity: ~1.0

Flash Point: No flash or >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1.0	Cu: <1.0
Cr:<1.0	Ni: <1.0
Hg:	Zn: <5.0
Pb:<5.0	Tl:
Cr+6: <1.0	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 12

Color: Yellow/brown

Physical State: Liquid

Free Liquids: 100%

pH: N/A

Specific Gravity: .8-1.0

Flash Point: >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd:<5	Cu: <10
Cr: <5	Ni: <2
Hg:	Zn: <500
Pb: <10	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 13

Color: Clear

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: 1.0

Flash Point: ?100 - >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <2
Cr: <2	Ni: <2
Hg:	Zn: <1
Pb: <2	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <500

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 14

Color: Blue with floating oil

Physical State: Liquid

Free Liquids: 100%

pH: ~9

Specific Gravity: ~1.02

Flash Point: >200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <15
Cr: <2	Ni: <2
Hg:	Zn: <50
Pb: <5	Tl:
Cr+6: <5	

Others: ppm

CN:	PCB:
S:	Phenolics: <500

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 15

Color: Dirty grey/yellow with visible oil

Physical State: Liquid

Free Liquids: 100%

pH: ~5.0

Specific Gravity: ~1.0

Flash Point: No Flash

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <5	Cu: <5
Cr: <5	Ni: <5
Hg:	Zn: <10
Pb: <5	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 16

Color: Dirty brown oily liquid

Physical State: Liquid

Free Liquids: 100%

pH: ~6

Specific Gravity: ~1.0

Flash Point: 101-200°F

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <5
Cr: <10	Ni: <5
Hg:	Zn: <100
Pb: <5	Tl:
Cr+6: <1	

Others:

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 17

Color: Dirty brown water

Physical State: Liquid

Free Liquids: 100%

pH: 3-8

Specific Gravity: ~1.0

Flash Point: No Flash

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <20	Cu: <10
Cr: <10	Ni: <10
Hg:	Zn: <150
Pb: <15	Tl:
Cr+6: <1	

Others: ppm

CN:	PCB:
S:	Phenolics: <10,000

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 18

Color: Brownish

Physical State: Liquid

Free Liquids: 100%

pH: 5-11

Specific Gravity:

Flash Point:

Metals: ppm

As:	Se:
Ba:	Ag:
Cd:<5.0	Cu: <5.0
Cr:<10	Ni:
Hg:	Zn: <5.0
Pb:<5.0	Tl:
Cr+6:	

Others: ppm

CN:	PCB:
S:	Phenolics: <100

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 19

Color: Amber

Physical State: Liquid

Free Liquids: 100%

pH: 7-9

Specific Gravity:

Flash Point: No Flash or $>200^{\circ}\text{F}$

Metals: ppm

As:	Se:
Ba:	Ag:
Cd:	Cu:
Cr: 5-500	Ni:
Hg:	Zn:
Pb:	Tl:
Cr+6:	

Others: ppm

CN:	PCB:
S:	Phenolics: $<1,000$

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 20

Color: Black

Physical State: Liquid

Free Liquids: 100%

pH: ~9

Specific Gravity: .8-1.0

Flash Point: No Flash

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: 50-500
Cr: 50-500	Ni: 50-500
Hg:	Zn: 50-500
Pb: 50-500	Tl:
Cr+6:	

Others: ppm

CN:	PCB:
S:	Phenolics:

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 21

Color: Yellow/White

Physical State: Liquid

Free Liquids: 100%

pH:

Specific Gravity:

Flash Point:

Metals: ppm

As:	Se:
Ba:	Ag:
Cd: <1	Cu: <1
Cr: <10	Ni: <1
Hg:	Zn: <10
Pb: <50	Tl:
Cr+6: <0.1	

Others: ppm

CN:	PCB:
S:	Phenolics: <1000

Typical Analysis of Most Frequently Handled Wastestreams

Wastestream: 22

Color: Varies, usually black

Physical State: Solid and/or Semi-solid

Free Liquids: 0%

pH: N/A

Specific Gravity: .8-1.4

Flash Point: >200°F

Metals: ppm

As:	0-1,000	Se:	0-500
Ba:	0-5,000	Ag:	0-500
Cd:	0-10,000	Cu:	0-10,000
Cr:	0-10,000	Ni:	0-10,000
Hg:	0-100	Zn:	0-10,000
Pb:	0-1,000	Tl:	0-100
Cr+6:	0-1,000		

Others: ppm

CN:	0-50 Free	PCB:	0-25
S:	0-50	Phenolics:	0-10,000

APPENDIX C-2
ANALYTICAL TEST METHODS

Revised, January 1990, December 1990, May 1991

COMPATIBILITY DETERMINATION PROCEDURE FOR CONTAINER AND WASTESTREAM CONSOLIDATION

After primary analyses are complete obtain approximate quart samples from each of the wastestreams to be consolidated. Place the sample with the pH closest to 7 in a mixing container. Add the other sample of the waste to be consolidated in approximately 20 ml portions and blend for one minute before the next addition.

Calculate the aliquot of waste to blend using the following equation:

$$\text{mls of sample} = \frac{\text{volume of wastestreams}}{\text{total volume of all wastestreams to be blended}} \times \text{final volume of consolidate samples}$$

The rate of addition of samples must be equal to or faster than the expected rate of addition of the actual waste to ensure that any possible reactions will be initially detected in the laboratory. The rate of mixing and the configuration of the mixing device will be as close as possible to that used in the actual tank.

Observe and record reactions every 10-15 minutes for up to one hour. Check for:

- Change in Temperature
- Gas Evolution or Foaming
- Precipitation
- Color Change
- Change in Physical State
- pH

If there are no significant severe reactions, the rate and volume of sample added may be increased. A compatibility test is run for every wastestream to be consolidated.

IGNITABILITY SCREEN

A small amount of material is passed through a flame at a controlled rate of approximately one foot/second. For liquid samples the flash point is recorded as less than 70°F, if the sample ignites prior to reaching the flame. If the liquid sample ignites while passing through the flame, the flash point is recorded as 70-99°F. If ignition does not occur until the sample passed through the flame a second time, the flash is recorded as 100-139°F. The flash point is recorded as 140-199°F if it must be passed through the flame a third time before it ignites. If the liquid sample ignites only after more sustained heating is observed, the flash point is recorded as >200°F. Halogenated solvents typically give off vapors that burn but do not sustain combustion when not directly in contact with the flame. Wastes exhibiting these characteristics are reported as having no flash and are checked for chlorinated solvents.

Solvents used to standardize the analyst's techniques are as follows.

Flash Point Range	Solvent	Actual Flash Point
<70°F	Methyl Isobutyl Ketone	60°F
70-99°F	Xylenes	84°F
100-139°F	Mineral Spirits	100°F
140-199°F	Kerosene	150-185°F
>200°F	Paraffin (Mineral) Oil	444°F

Radioactivity Test

1.0 Summary of Method

- 1.1 A radioactivity monitor is used to determine overall spontaneous radioactivity energies. Background readings are taken around an empty sample container at specified distances and orientations. The radioactivity measurement is the difference between the sample and background measurements at each point. Any measurement greater than 20% of the corresponding background measurement is considered to be "above background."
- 1.2 Reference: "Instructions for Completing Paperwork in Radioactive Waste Shipment and Disposal", U.S. Ecology, Inc., 1988.

2.0 Equipment

- 2.1 The radioactivity monitor used is a Radiation Alert Monitor 4, or equivalent. The detector is a halogen quenched GM tube (1.5 mg/cm^2) with a $\pm 10\%$ accuracy. The unit measures overall spontaneous radioactivity energies and does not distinguish between radioactive particles. Particle efficiencies are as follows:
 - 80% alpha (α)
 - 75% beta (β)
 - 100% gamma (γ), and X-ray
- 2.2 The sample container must be a four ounce to one quart size plastic or glass cylindrical jar with no lid. The background measurements used for each sample must be taken on a container made of equivalent material.

3.0 Procedure

3.1 Background Measurement (Measurement B)

- 3.1.1 A background measurement will be determined by setting the detector scale to 0 to 50 mR/hr and taking detector readings (on a blank sample jar), recording the data on Table I below, then averaging the data collected from each position indicated on Figure I.
- 3.1.2 At least six (6) readings for each position should be taken at approximately 10 to 15

second intervals over a minute and a half time span. These measurements are listed separately on Table I, then averaged at the bottom of each column.

3.1.3 Background measurements must be calculated on the same day in which actual sample testing is done, on a sample bottle made of equivalent material, and should be repeated when any surrounding environmental conditions change (i.e. sunlight, smoke, room light, etc.).

3.1.4 No known source of radioactivity should exist along the directional axis between the detector and the sample container or within 50 ft of the testing grid identified in Figure I.

3.2 Sample Measurement (Measurement S)

3.2.1 Samples will be tested in the same manner described above for background testing, with the measurements recorded in Table II.

3.3 Measurement Value (Measurement M)

3.3.1 The calculated radiation measurements are determined using the following equation and are then recorded in Table III.

$$Mx1 = Sx1 - Bx1$$

3.3.2 If any value of M exceeds 20% of the corresponding B value, the sample is considered to be radiating above background and should be handled using proper radioactivity handling techniques. The 20% value was determined from the additive possible error of 10% from each measurement (sample and background) due to the inherent error in the instrument used for measurement.

3.3.3 If any sample is found to exceed background as described above, the sample and background readings should be re-verified before alerting the plant manager.

4.0 Interferences

4.1 Interferences can include sunlight, smoke, room light, watches with luminescent dials, microwaves, other analytical equipment, heavy metals which have been temporarily irradiated, dueterated organic compounds used for "isotope dilution" Gas Chromatography/Mass Spectrometry (GC/MS), etc.

5.0 Quality Control (QC)

- 5.1 Daily QC involves checking the battery charge each day the monitoring instrument is used.
- 5.2 Annual QC involves returning the monitoring instrument to the manufacturer for service and testing or checking the levels of an actual radioactive source. The second method is not advisable currently as no safe method for this has been determined.

TABLE I: Background Measurement (B)
(measurement units: mR/hr)

Measurement	X ₁	X ₂	Y ₁	Y ₂	Z ₁	Z ₂
1						
2						
3						
4						
5						
6						
Average B Value	B _{X1}	B _{X2}	B _{Y1}	B _{Y2}	B _{Z1}	B _{Z2}

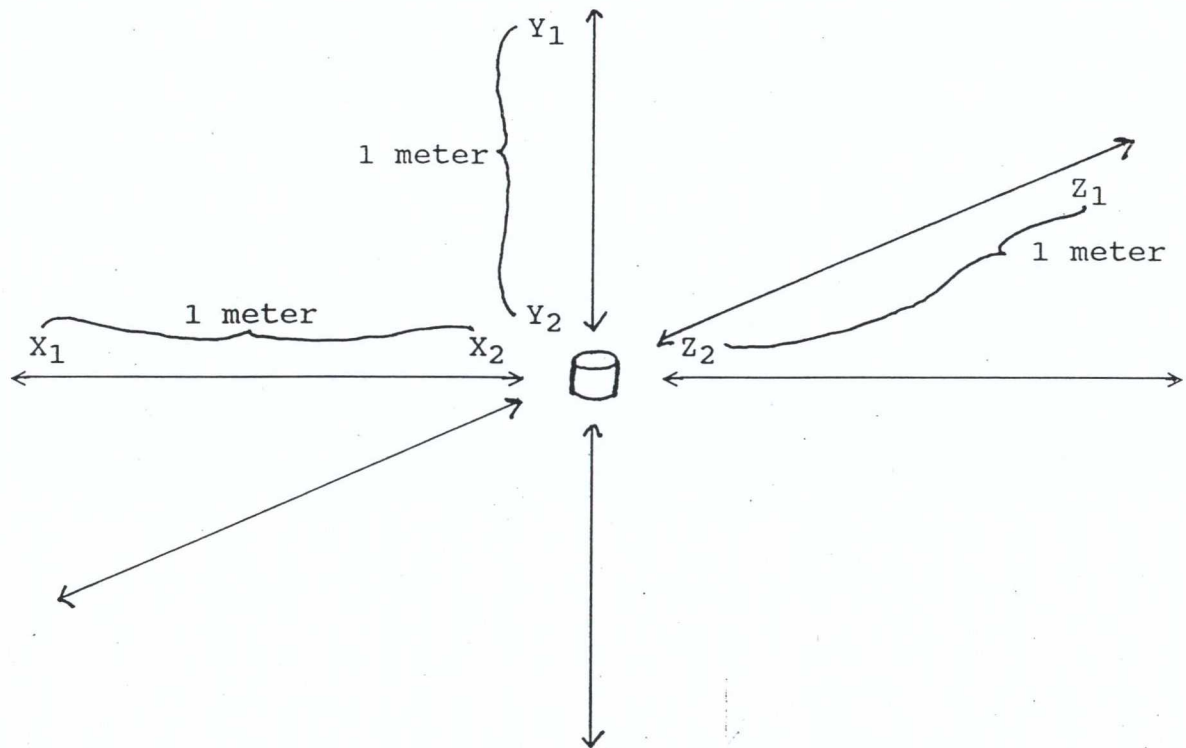
TABLE II: Sample Measurement (S)
(measurement units: mR/hr)

Measurement	X ₁	X ₂	Y ₁	Y ₂	Z ₁	Z ₂
1						
2						
3						
4						
5						
6						
Average S Value	S _{X1}	S _{X2}	S _{Y1}	S _{Y2}	S _{Z1}	S _{Z2}

TABLE III: Measurement Value (M)
(measurement units: mR/hr)

Measurement	Value	20% Background	Value	Exceeds Background?
M _{X1}		$.20 \times B_{X1}$		
M _{X2}		$.20 \times B_{X2}$		
M _{Y1}		$.20 \times B_{Y1}$		
M _{Y2}		$.20 \times B_{Y2}$		
M _{Z1}		$.20 \times B_{Z1}$		
M _{Z2}		$.20 \times B_{Z2}$		

FIGURE I: Measurement Points



PRIMARY ANALYSES

PHYSICAL DESCRIPTION

Samples are inspected and the physical appearance of the waste is recorded, including:

Color

Physical State (solid, liquid, semi-solid)

Sludge content

Layering (Number and ratio of phases; if multiple phases are present, color and viscosity for all phases is reported.)

Odor (Only reported if easily detected. For safety, personnel are instructed not to smell samples.)

Presence and percentage of free liquids

pH ANALYSIS

A pH meter or full-range pH paper is used directly on liquid samples and on the free liquid portion of liquid/solid samples. For solid samples a 1:1 water-to-solid mixture is prepared and tested.

The complete analytical methods for measuring pH are described in Methods 9040, 9041 and 9045, Test Methods for Evaluating Solid Waste, SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington D.C. 20406, November 1986.

WATER MIX SCREEN

If the waste is solid or oily it is added to water under cover of a hood. For liquid wastes, water is added to the waste. If the waste is water reactive, the generation of gases, heat or turbulence is recorded. The ratio of sample to water is dependent on which property is being determined. For each of the following properties the sample to water ratio is noted. If the reaction is questionable, the amount of sample is scaled up with 2 times the amount of water. The following properties or waste characteristics are also noted:

Gross solubility in water, (the continuous addition of waste until the solubility point is reached).

Whether waste is heavier or lighter than water. Liquid is added drop by drop. Solid is added chunk by chunk.

Whether waste forms an emulsion in a 1:1 mixture with water. The solution is shaken, stirred and allowed to settle.

pH of a 1:1 mixture with water.

Reference: Design and Development of a Hazardous Waste Reactivity Testing Protocol, EPA-600/2-84-057, 1984.

WATER REACTIVE CHEMICALS

The following list of water reactive chemicals is also referred to for determination of water reactivity.

Reference: Prudent Practices for Disposal of Chemicals From Laboratories, National Academy of Sciences, National Academy Press, 1983.

This appendix lists some common chemicals that react violently with water and that should always be stored and handled so that they do not come into contact with liquid water or water vapor. They are prohibited from landfill disposal, even in a lab pack, because of the characteristic of reactivity.

Alkali metals

Alkali metal hydrides

Alkali metal amides

Metal alkyls, such as lithium alkyls and aluminum alkyls

Grignard reagents

Halides of nonmetals, such as BCl_3 , BF_3 , PCl_3 , PCl_5 , SiCl_4 , S_2Cl_2

Inorganic acid halides, such as POCl_3 , SOCl_2 , SO_2Cl_2

Anhydrous metal halides, such as AlCl_3 , TiCl_4 , ZrCl_4 , SnCl_4

Phosphorus pentoxide

Calcium carbide

Organic acid halides and anhydrides of low molecular weight

IGNITABILITY SCREEN

A small amount of material is passed through a flame at a controlled rate. For liquid samples the flash point is recorded as less than 70°F, or room temperature, if the sample ignites immediately. If the liquid sample ignites while passing through the flame, the flash point is recorded as 70-100°F. If ignition does not occur until the sample is almost completely through the flame, the flash is recorded as 100-140°F. The flash point is recorded as >140°F if it must be passed through the flame a second time before it ignites. If the liquid sample ignites only after more sustained heating is observed, the flash point is recorded as >200°F. Halogenated solvents typically give off vapors that burn but do not sustain combustion when not directly in contact with the flame. Wastes exhibiting these characteristics are reported as having no flash and are checked for chlorinated solvents.

HEXAVALENT CHROMIUM (Cr^{+6}) SPOT TEST

1.0 SUMMARY OF METHOD

- 1.1 Hexavalent chromium is determined colorimetrically by reaction with diphenylcarbohydrazide in acid solution. A reddish violet color of unknown composition is produced.
- 1.2 Reference: Method 312B, Standard Methods for the Examination of Water and Wastewater, 16th Edition.

2.0 REAGENTS

- 2.1 Concentrated sulfuric acid, H_2SO_4
- 2.2 *Diphenylcarbohydrazide solution, 250 mg
1,5-diphenylcarbohydrazide in 50 ml denatured ethanol.
Store in a brown bottle.

3.0 PROCEDURE

- 3.1 Add 2 drops of sample to a spot plate.
- 3.2 Add 2 drops of H_2SO_4 and mix.
- 3.3 Add 2 drops of diphenylcarbohydrazide solution and mix.
- 3.4 If a reddish - violet color develops, positive for hexavalent chromium.

*Diphenylcarbohydrazide solution loses potency as a test reagent in 1-2 weeks. When the solution has lost potency, all samples tested will appear purple-orange. Run a test on a blank, deionized (DI) water with each analysis. If it colors DI water purple-orange, make up new reagent.

PHENOLICS SPOT TEST

1.0 SUMMARY OF METHOD

- 1.1 Phenolic materials react with 4-aminoantipyrine in the presence of potassium ferricyanide at a pH of 10 to form a stable reddish-brown colored antipyrine dye. The amount of color produced is a function of the concentration of phenolic material.
- 1.2 Reference: See Phenolics, Total Recoverable in this Appendix.

2.0 REAGENTS

- 2.1 5% Ammonium Chloride
- 2.2 Concentrated NH_4OH
- 2.3 pH 10 Buffer Solution
- 2.4 2% 4-Aminoantipyrine Solution
- 2.5 8% Potassium Ferricyanide Solution

3.0 PROCEDURE

- 3.1 To an aliquot of sample diluted to 100 ml, add 0.5-2 mls of 5% ammonium chloride.
- 3.2 Bring the pH to 10 with additions of concentrated NH_4OH .
- 3.3 Add 1 ml of 4-aminoantipyrine solution and mix.
- 3.4 Add 1 ml of potassium ferricyanide and mix.
- 3.5 After 15 minutes check the color of the solution. If pink or red, phenolics are positive.

4.0 PROCEDURE FOR SPOT PLATE

- 4.1 Put one drop of sample in spot.
- 4.2 Fill spot with pH 10 buffer solution
- 4.3 Add one drop of 4-aminoantipyrine solution
- 4.4 Add one drop of potassium ferricyanide solution
- 4.5 No color change indicates <10 ppm
pink indicates 10-100 ppm
red-purple indicates >100 ppm.

CYANIDE (Free) SPOT TEST

1.0 SUMMARY OF METHOD

- 1.1 Free cyanide is converted to CNCl and developed into a color complex with barbituric acid. The amount of color produced is a function of the concentration of cyanide.
- 1.2 Reference: See Cyanides, Total by Distillation in this Appendix.

2.0 REAGENTS

- 2.1 10% NaOH (w/w)
- 2.2 Concentrated Phosphoric Acid
- 2.3 Sodium Phosphate Buffer Solution
- 2.4 2% EDTA (w/v)
- 2.5 1% Chloramine-T Solution (w/v)
- 2.6 Pyridine-Barbituric Acid Solution

3.0 PROCEDURE

- 3.1 Take an aliquot of sample and bring to volume of 100 mls using deionized water.
- 3.2 Add 1 ml of 10% NaOH.
- 3.3 Add phosphoric acid drop-wise until pH reaches 7 to 7.5
- 3.4 Add a few drops of EDTA.
- 3.5 Add 2 mls of chloramine-T solution. Mix and wait one minute.
- 3.6 Add 5 mls of pyridine-barbituric acid solution and mix.
- 3.7 Read color of solution after 5 minutes. If rosy or pink color develops, positive for free cyanide.

CYANIDE (Free) SPOT TEST
(continued)

4.0 PROCEDURE FOR SPOT PLATE

- 4.1 Put a drop of sample in spot
- 4.2 Add 0-3 drops 10% NaOH (depending on initial pH of sample)
- 4.3 Fill spot with sodium phosphate buffer solution.
- 4.4 Add 1 drop chloramine-T solution
- 4.5 Add 3 drops pyridine barbituric acid solution
- 4.6 No color indicates <1 ppm
pink to purple indicates 1-5 ppm
dark purple indicates >5 ppm

TREATABILITY TEST

1.0 SUMMARY OF METHOD

The sample is mixed with a group of acids similar to those found at the Tacoma plant consolidation tank. The sample is then neutralized with lime and analyzed for metal content and possible chelates.

2.0 REAGENTS

- 2.1 Tacoma Composite Acid
- 2.2 Sodium Bisulfite (39% solution)
- 2.3 Supersaturated Calcium Hydroxide Solution (slaked lime)
- 2.4 10% Aluminum Sulfate Solution (alum)
- 2.5 9% Sodium Sulfide Solution
- 2.6 5.6% Ferric Chloride ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$)
- 2.7 Sodium Dimethyl Dithiocarbamate (Bufloc)

3.0 PROCEDURE

- 3.1 Place 3 ml of sample into a 100 ml beaker.
- 3.2 Add 27 ml of Tacoma composite acid to the sample.
- 3.3 Bring pH to 2 to 3 with slaked lime.
- 3.4 Add enough sodium bisulfite to reduce the hexavalent chrome to trivalent chrome by changing the solution from yellow to green/blue.
- 3.5 Neutralize the solution to between pH 8.0 and 8.5 with slaked lime.
- 3.6 Filter through a Whatman No.2 paper filter.
- 3.7 Test the metals content on the filtrate by Atomic Absorption. If metals are greater than 1 ppm, suspect possible chelated metals.

TREATABILITY TEST
(continued)

3.8 For high chromium content.

3.8.1 Check for pH >8.5.

3.8.2 If high, repeat the dilution of the sample with Tacoma composite acid (steps 3.1-3.4). If pH is 8.0-8.5, use the remaining liquid from the first neutralization.

3.8.3 Add aluminum sulfate to the solution.

3.8.4 Re-basify with lime to pH 8.0 to 8.5.

3.8.5 Filter and analyze for chromium by Atomic Absorption.

3.9 For high copper, lead, cadmium or zinc

3.9.1 Repeat the dilution of the sample with Tacoma composite acid (steps 3.1-3.4), or use the remaining liquid from the first neutralization.

3.9.2 Add 2 drops of sodium sulfide solution.

3.9.3 If not much floccing occurs, add some FeCl_3 or alum until colloids form.

3.9.4 Re-basify with lime if necessary (pH should be 8.0-8.5). Filter and analyze for copper, lead, cadmium or zinc by Atomic Absorption.

3.10 For high nickel

3.10.1 Repeat the dilution of the sample with Tacoma composite acid (steps 3.1-3.4), or use the remaining liquid from the first neutralization.

3.10.2 Add alum to the sample.

3.10.3 Add 2 drops of sodium sulfide.

3.10.4 Add lime to adjust pH 8.0-8.5 if needed. Filter.

3.10.5 Analyze for nickel by Atomic Absorption. If nickel still high, can add FeCl_3 to pH 5 and re-basify with lime but it creates a lot of sludge.

TREATABILITY TEST
(continued)

4.0 ATOMIC ABSORPTION ANALYSIS

Refer to the method for measuring Metals by Atomic Absorption found in this Appendix.

CHLORINATED SOLVENT SCREEN-Beilstein Test

A small amount of a substance is placed in a small loop of a copper wire and held in a flame. Halogenated compounds impart a distinct green color to the flame.

Reference: Page 97, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy of Sciences, National Academy Press, 1983.

TEST FOR REACTIVE SULFIDE

1.0 SUMMARY OF METHOD

- 1.1 On exposure to vapor of a slightly acidified sample, lead acetate paper will blacken by formation of PbS.
- 1.2 Reference: Method 427, Standard Methods for the Examination of Water and Wastewater, 16th edition.

2.0 REAGENTS

- 2.1 1:1 Hydrochloric Acid (HCl)
- 2.2 Lead Acetate Test Paper

3.0 PROCEDURE

- 3.1 Place 6 to 10 drops of sample in a test tube.
- 3.2 Add 2 to 3 mls of 1:1 HCl. Mix.
- 3.3 Hold lead acetate test paper, premoistened with water, in test tube above the sample.
- 3.4 No color change indicates a negative response and a brownish-black color indicates a positive test for reactive sulfide.

COMPATIBILITY DETERMINATION PROCEDURES

COMPATIBILITY DETERMINATION PROCEDURE FOR CONTAINER AND
WASTESTREAM CONSOLIDATION

After primary analyses are complete obtain approximate quart samples from each of the wastestreams to be consolidated. Place the sample with the pH closest to 7 in a mixing container. Add the other sample of the waste to be consolidated in approximately 20 ml portions and blend for one minute before the next addition. Observe and record reactions every 10-15 minutes for up to one hour. Check for:

- Change in Temperature
- Gas Evolution or Foaming
- Precipitation
- Color Change
- Change in Physical State
- pH

If there are no significant severe reactions, the rate and volume of sample added may be increased. A compatibility test is run for every wastestream to be consolidated.

PROPOSED GUIDE FOR ESTIMATING THE INCOMPATIBILITY OF SELECTED
HAZARDOUS WASTES BASED ON BINARY CHEMICAL REACTIONS

The test method is described in ASTM D-34, Proposal P 168,
Proposed Guide for Estimating the Incompatibility of Selected
Hazardous Wastes Based on Binary Chemical Reactions, American
Society for Testing Materials, 1916 Race Street, Philadelphia, PA
19103, March 1986.

TRIAL TREATMENT

1.0 SUMMARY OF METHOD

A sample of the tank contents is subjected to a bench scale trial treatment. The treatment includes heat treatment, chemical precipitation, dewatering, clarification, coagulation and flocculation or various optimum combinations of these treatments.

2.0 REAGENTS

- 2.1 Pier 91 Composite Emulsified Wastestream - approximately 5-100 ml samples
- 2.2 Clarifying agents - Calcium chloride or other inorganic salts
- 2.3 Floccing agents used at the site include ferric chloride (FeCl_3), aluminum sulfate ($\text{Al}_2(\text{SO}_4)_3$) and sodium hydroxide (NaOH). Other flocculants which may be used are ferrous sulfate, sulfides, polysulfides, dithiocarbamate and synthetic polyelectrolytes.
- 2.3 Coagulating agents - aluminum sulfate or cationic, anionic and nonionic polymers
- 2.4 Dewatering agents - Sodium silicate, cationic, anionic or nonionic polymers
- 2.5 Precipitating agents - Aluminum sulfate ($\text{Al}_2(\text{SO}_4)_3$), ferric chloride (FeCl_3) and sodium hydroxide (NaOH) are the major treatment chemicals used for demulsification by precipitation and flocculation. A variety of precipitating agents may be used including ferrous chloride, ferrous sulfate, dithiocarbamate salts, sodium borohydride and calcium polysulfide.
- 2.8 Heat

3.0 PROCEDURE

Combinations of the possible treatments are applied to find the optimum conditions for breaking the emulsion. A treatment log is kept so that the conditions may be scaled up and duplicated for the tank treatment.

pH RANGES FOR PRECIPITATION OF METAL HYDROXIDES

Ag ⁺	9-14*
Al ³⁺	7-8
As ³⁺	Precipitated as Sulfide
As ⁵⁺	Precipitated as Sulfide
Cd ²⁺	7-14*
Cr ³⁺	7-14*
Cu ⁺	9-14*
Cu ²⁺	7-14*
Fe ²⁺	7-14*
Fe ³⁺	7-14*
Hg ⁺	8-14*
Hg ²⁺	8-14*
Ni ²⁺	8-14*
Pb ²⁺	7-8
Se ⁴⁺	Precipitated as Sulfide
Se ⁶⁺	Precipitated as Sulfide
Tl ³⁺	9-14*
Zn ²⁺	7-8

*Denotes that precipitated metal hydroxide will not dissolve in 1N NaOH solution.

SECONDARY ANALYSES

PHENOLICS, TOTAL RECOVERABLE

1.0 SUMMARY OF METHOD

- 1.1 Phenolic materials react with 4-aminoantipyrine in the presence of potassium ferricyanide at a pH of 10 to form a stable reddish-brown colored antipyrine dye. The amount of color produced is a function of the concentration of phenolic material.
- 1.2 Reference: Method 9065 (Spectrophotometric, Manual 4-AAP with Distillation), Test Methods for Evaluating Solid Waste EPA, SW-846, November 1986.

2.0 REAGENTS

2.1 Preparation of Reagents

- 2.1.1 Concentrated H_2SO_4
- 2.1.2 Buffer solution: Dissolve 16.9 g NH_4Cl in 143 ml concentrated NH_4OH and dilute to 250 ml with DI water. Store at 4°C .
- 2.1.3 2% 4-Aminoantipyrine Solution: prepare fresh daily.
- 2.1.4 8% Potassium Ferricyanide Solution: prepare fresh weekly and store at 4°C .
- 2.1.5 Stock Phenol Solution: Dissolve 1.0 g phenol in DI water and dilute to 1 liter.
- 2.1.6 Working solution: Dilute 10 ml stock phenol solution to 1 liter with DI water (1 ml = 10 ug phenol).

2.2 Standards Preparation

- 2.2.1 1000 ppm Stock Phenol Solution: Dissolve 1.00 g phenol in deionized water and dilute to 1000 mls. Store in dark bottle. Label and date.
- 2.2.2 10 ppm Intermediate Phenol Solution: Dilute 1 ml of stock phenol solution to 100 mls with deionized water (or 2.5 mls to 250 mls). Prepare fresh daily.

PHENOLICS, TOTAL RECOVERABLE
(continued)

2.2.3 Preparation of standard curve:

<u>mg/100 mls</u>	<u>mls of Intermediate Phenol Solution/100 mls</u>
0.0	0
0.05	5
0.1	10
0.2	20
0.3	30
0.4	40

2.2.4 Plot of standard curve is Absorbance vs.
mg phenol/100 mls.

3.0 SAMPLE PRESERVATION

3.1 Lower pH to <4 with H_2SO_4 (~1 ml/L) and store at 4°C.

4.0 PROCEDURE

4.1 Distillation

4.1.1 Measure 100 ml sample into a single neck boiling flask. Adjust pH to 4 with dilute NH_4OH or H_2SO_4 . Add boiling chips. Attach boiling flask to distillation apparatus.

4.1.2 Distill 90 ml of sample, stop the distillation, and when boiling ceases add 10 ml of DI water to the flask and resume distillation until 100 ml have been collected.

4.2 Direct Photometric Method

4.2.1 To 100 ml of distillate or an aliquot diluted to 100 ml, add 2 mls of buffer solution and mix.

4.2.2 pH of the sample and standards should be 10 ± 0.2 .

4.2.3 Add 2.0 ml of 4-aminoantipyrine solution and mix.

4.2.4 Add 2.0 ml of potassium ferricyanide solution and mix.

4.2.5 After 15 minutes read absorbance at 510 nm.

5.0 CALCULATION

5.1 Prepare a standard curve by plotting the absorbance value of standards versus the corresponding phenol concentration.

5.2 Phenol, ug/ml = $\frac{A \times 1000}{B}$

where: A = mg of phenol/100 mls from standard curve
B = mls of sample (diluted to 100 mls) colored.

6.0 INTERFERENCE

6.1 Sulfur compounds that cause interference are eliminated by acidifying the sample to a pH < 4 with H₂SO₄ and aerating briefly by stirring.

6.2 If oxidizing agents, such as chlorine, are suspected, they can be detected by using HCl acidified KI starch test paper which turns blue when dipped in the sample. If oxidizing agents are found, they are removed immediately after sampling by the addition of an excess of ferrous ammonium sulfate.

6.3 If the distillate is turbid, filter through a prewashed membrane filter before coloring.

METALS BY ATOMIC ABSORPTION

1.0 SUMMARY OF METHOD

- 1.1 A representative sample (5 to 10 g wet weight) is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with either nitric acid (for furnace AA analysis) or hydrochloric acid (for flame AA analysis).
- 1.2 Reference: Method 3050, Test Methods for Evaluating Solid Waste EPA, SW-846, November 1986.

2.0 REAGENTS

- 2.1 ASTM Type II Water (ASTM D1193)
- 2.2 Concentrated Nitric Acid (HNO_3)-reagent grade
- 2.3 Concentrated Hydrochloric Acid (HCl)-reagent grade
- 2.4 Hydrogen Peroxide (30% H_2O_2)

3.0 PROCEDURE

- 3.1 Mix the sample thoroughly. Weigh to the nearest 0.01 g and transfer a 5 to 10 g portion of the sample to a digestion flask.
- 3.2 Add 5 mls of Type II water and 5 mls HNO_3 and cover with a reflux cap. Reflux for 10-15 minutes without boiling. Cool, then add 5 ml HNO_3 and reflux for 30 minutes. Repeat acid additions until oxidation is complete. Cool sample.
- 3.3 Add 2 ml Type II water and 3 ml of 30% H_2O_2 . Cover and heat until reaction subsides. Cool and repeat adding 3 ml H_2O_2 . Repeat again adding 4 ml H_2O_2 .
- 3.4 If the sample is being prepared for flame analysis cool and add 5 ml Type II water and 5.0 ml concentrated HCl . Heat for 15 minutes, cool, filter through Whatman 541 paper to remove particulates (if necessary) and dilute to 50 mls with Type II water.
- 3.5 For furnace analyses omit step 3.4, cool, filter and dilute the sample to 50 mls with Type II water.

METALS BY ATOMIC ABSORPTION
(continued)

4.0 FOR COMBUSTIBLE SAMPLES

- 4.1 Accurately weigh ≤ 1 g of sample into a crucible.
- 4.2 Bomb sample in Parr oxygen bomb containing 10 mls of 10% HNO_3 in the bottom (this is especially appropriate for volatile metals).
- 4.3 Transfer Bomb washings to volumetric flask.
- 4.4 Combustible samples can also be prepped by ashing a known amount at temperatures $< 550^\circ\text{C}$. (This is appropriate especially for those metals which leach out of the Bomb.)
- 4.5 Digest ash in HNO_3 , then filter into a volumetric flask.

5.0 SPECIAL CIRCUMSTANCES

- 5.1 Metals requiring special digestions are prepared according to methods from Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Laboratory Manual, Vol. 1A, EPA SW-846.

6.0 INSTRUMENTATION

- 6.1 Settings and apparatus used for metals analysis can be found in Vol. 1, EPA SW-846 and in the individual instrument manuals.

7.0 CALCULATIONS

- 7.1 Select at least three concentrations of each standard metal solution to bracket the expected metal concentration of a sample. Prepare a calibration curve by plotting peak height of standards versus the concentration for each metal.
- 7.2 Refer to the appropriate calibration curve to calculate the concentration of each metal ion.

SULFIDE QUANTITATIVE ANALYSIS

1.0 SCOPE AND APPLICATION

The method employed is a modification of Method 9030, combining 9030 with 9010. It is used to measure the concentration of total and dissolved sulfides in drinking, surface and saline waters, and domestic and industrial wastes. The method does not measure acid-insoluble sulfides; copper sulfide is the only common acid-insoluble sulfide. This method is suitable for measuring sulfide in concentrations above 1 mg/l.

2.0 SUMMARY OF METHOD

- 2.1 Excess iodine is added to a sample which may or may not have been treated with zinc acetate to produce zinc sulfide. The iodine oxidizes the sulfide to sulfur under acidic conditions. The excess iodine is back-titrated with sodium thiosulfate or phenylarsine oxide.
- 2.2 Reference: Test Methods for Evaluating Solid Waste, SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986. Method 9030 and 9010

3.0 INTERFERENCES

- 3.1 Reduced sulfur compounds that decompose in acid, such as sulfite, thiosulfate and hydrosulfite, may yield erratic results. Also, volatile iodine-consuming substances will give high results.
- 3.2 Samples must be taken with a minimum of aeration in order to avoid volatilization of sulfides and reaction with oxygen which may convert sulfide to unmeasurable forms.
- 3.3 If the sample is not preserved with zinc acetate, analysis must start immediately.
- 3.4 If a sample is a solid waste or if it is not clear enough to note any color change during a titration, it must be distilled as in Method 9010, 7.3.1 - 7.3.5 for cyanide.

4.0 APPARATUS AND MATERIALS

Ordinary laboratory glassware.

SULFIDE QUANTITATIVE ANALYSIS
(continued)

5.0 REAGENTS

- 5.1 Hydrochloric Acid, HCl, 6 N.
- 5.2 Phenylarsine Oxide, 0.0250 N, or Sodium Thiosulfate, 0.0250N: Commercially available.
- 5.3 Starch Indicator: Commercially available.
- 5.4 Potassium Iodide, KI crystals.
- 5.5 Amylose (Starch) Indicator.
- 5.6 Standard Iodine Solution, 0.0250 N: Dissolve 20 to 25 g KI in a little water in a liter volumetric flask and add 3.2 g iodine. Allow to dissolve. Dilute to 1 liter and standardize against 0.0250 N sodium thiosulfate or phenylarsine oxide using a starch indicator, as follows.
 - a. Dissolve approximately 2 g (± 1 g) KI crystals in 100 to 150 ml distilled water.
 - b. Add 20 ml of the iodine solution to be standardized and dilute to 300 ml.
 - c. Titrate with 0.0250 N phenylarsine oxide (PAO), or sodium thiosulfate until a pale straw color occurs.
 - d. Add a small amount of amylose indicator and wait until a homogeneous blue color develops.
 - e. Continue titration drop by drop until the color disappears.
 - f. Run in duplicate.
 - g. Calculate normality by the following equation:

$$NI_2 = \frac{\text{ml Titrant} \times 0.0250}{20}$$

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

- 6.1 All samples must be collected using representative methods.
- 6.2 Aqueous samples must be preserved with zinc acetate or the analysis must be started immediately.

SULFIDE QUANTITATIVE ANALYSIS
(continued)

7.0 PROCEDURE

7.1 Solid Waste Samples

7.1.1 Distill 25-100 g of sample as in Method 9010, 7.2 for cyanide. Instead of using 50 ml of 1:1 H₂SO₄, use 50 ml 1:1 HCl and no magnesium chloride.

7.1.2 Titrate an aliquot (about 25 ml) with reducing solution (0.0250 N sodium thiosulfate or 0.0250 N phenylarsine oxide solution) using the starch indicator until the blue color disappears. Record the number of ml used.

7.1.3 Calculations: 1 ml of 0.0250 N Standard Iodine solution reacts with 0.4 mg of sulfide present in the titration vessel. Thus, the following equation should be used to calculate sulfide concentration:

$$\text{mg/l sulfide} = \frac{400 (A-B)(C)}{\text{ml sample aliquot}} \times \frac{250}{\text{g of sample distilled}}$$

Where:

A = ml of 0.0250N standard iodine solution

B = ml of 0.0250N standard reducing sodium thiosulfate or phenylarsine oxide solution

C = normality adjustment

8.0 QUALITY CONTROL

8.1 All quality control data should be maintained and available for easy reference or inspection.

8.2 Dilute samples if they are more concentrated than the highest standard or if they fall on the plateau of a calibration curve.

8.3 Employ a minimum of one blank per sample batch to determine if contamination has occurred.

8.5 Run one duplicate sample for every 10 samples or once a month if 10 samples have not been analyzed. (A duplicate sample is a sample brought through the whole sample preparation process.)

SPECIFIC GRAVITY (DENSITY)

Reference: ASTM D 1298-85, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method. 1986 Annual Book of ASTM Standards, American Testing Society for Testing Materials, 1916 Race Street, Philadelphia, PA 19103.

Note: The method is applicable to recording specific gravities to the nearest 0.0001. Chemical Processors, Inc. reports specific gravities to the nearest 0.1. Therefore the constant-temperature bath, Section 7.4, is not used.

CYANIDE QUANTITATIVE ANALYSES

CYANIDE, TOTAL BY DISTILLATION

1.0 SUMMARY OF METHOD

- 1.1 Metal cyanide is converted to HCN gas, which is distilled and absorbed in sodium hydroxide solution. Amenable cyanide is converted to CNCl and developed into a color complex with barbituric acid. The amount of color produced is a function of the concentration of cyanide.
- 1.2 Reference: Methods 412B and 412D of Standard Methods for the Examination of Water and Wastewater, 16th Edition.

2.0 SAMPLE PRESERVATION AND HANDLING

- 2.1 The sample should be collected in plastic or glass bottles of 1 liter or larger size. All bottles must be thoroughly cleaned and thoroughly rinsed to remove soluble material from containers.
- 2.2 Oxidizing agents such as chlorine decompose most of the cyanides. Test a drop of the sample with HCl acidified potassium iodide-starch test paper (KI-starch paper). A blue color indicates the need for treatment. Add ascorbic acid or sodium thiosulfate, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add an additional 0.6 g of ascorbic acid for each liter of sample volume (if ascorbic acid was used).
- 2.3 Samples must be preserved with 2 ml of 10 N sodium hydroxide per liter of sample ($\text{pH} \geq 12$) at the time of collection.
- 2.4 Samples should be analyzed as rapidly as possible after collection. If storage is required, the samples should be stored in a refrigerator or in an ice chest filled with water and ice to maintain temperature at 4°C.

CYANIDE, TOTAL BY DISTILLATION
(continued)

3.0 REAGENTS

3.1 Preparation of Reagents

3.1.1 0.25N Sodium Hydroxide (10 g/l)

3.1.2 51% Magnesium Chloride (510 g $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ diluted to 1 liter with DI water)

3.1.3 Concentrated Sulfuric Acid

3.1.4 Reagent Grade Ascorbic Acid or Sodium Thiosulfate

3.1.5 1.0 M Sodium Phosphate Monobasic (3N) (138 g/l) (store at 4°C)

3.1.6 1% Chloramine-T solution, 1 g in 100 ml water (store at 4°C and make up fresh weekly)

3.1.7 Pyridine-Barbituric Acid Solution: Place 15 g of barbituric acid in a 250 ml volumetric flask and add just enough water to wash sides of flask and wet barbituric acid. Add 75 ml pyridine and mix. Add 15 ml concentrated hydrochloric acid, mix, and cool to room temperature. Dilute to mark with water and mix. Store at 4°C in the dark. This solution is stable for 6 months or until precipitate forms.

3.2 Stock Standards

3.2.1 Stock cyanide solution: Dissolve 2.51 g KCN and 2 g KOH in 1 liter of distilled water. Standardize with 0.0192 N AgNO_3 .

3.2.2 Standard cyanide solution, intermediate: Dilute 50.0 ml of stock (1ml = 50 ug CN^-) to 1000 ml with distilled water.

3.2.3 Working cyanide solution: Prepare fresh daily by diluting 100.0 ml of intermediate cyanide solution to 1000 ml with distilled water and store in a glass stoppered bottle. 1 ml = 5.0 ug CN^- (5.0 mg/L).

CYANIDE, TOTAL BY DISTILLATION
(continued)

4.0 PROCEDURE

4.1 Distillation

4.1.1 Test sample with HCl acidified KI starch test paper. If paper turns blue, add ascorbic acid or sodium thiosulfate, a couple of grains of at a time until KI paper does not react. Add 0.6 g ascorbic acid in excess, if ascorbic acid is used.

4.1.2 Rinse out a 1 liter round bottom flask with water. Add 200 ml of liquid sample to flask (or 5-10 g solid, diluted to 200 mls with DI water).

4.1.3 Add boiling chips to flask and connect to distillation apparatus. Turn on water to condensers.

4.1.4 Add 50 mls 0.25 NaOH to scrubber test tube. Put in bubbler tube and attach to hose system. Turn on vacuum system and adjust flow to 2 air bubbles/s.

4.1.5 If Nitrate or Nitrite is suspected, add 2 g sulfamic acid through the air inlet tube and wash down with DI water.

4.1.6 Add 25 mls of H_2SO_4 through the inlet tube the flask. Rinse down with DI water. Allow to mix 3 minutes.

4.1.7 Add 20 mls of $MgCl_2$ through the inlet tube into the flask. Rinse down with DI water.

4.1.8 Heat, watch carefully for approximately 15 minutes to rapid boiling. Boil for one hour. Cool for 15 minutes and remove the scrubber tube. Rinse over the contents of the scrubber solution into a 100 ml volumetric flask with DI water and bring to volume with same.

4.2 Colorimetric Method

4.2.1 Place a measured aliquot of the diluted scrubber solution into a 50 ml volumetric flask.

4.2.2 Dilute to 20 mls with 0.25N NaOH.

4.2.3 Add 15 mls of sodium phosphate monobasic to the flask.

4.2.4 Add 2 mls of chloramine-T solution. Mix and wait one minute.

CYANIDE, TOTAL BY DISTILLATION
(continued)

4.2.5 Add 5 mls of pyridine-barbituric acid solution.

4.2.6 Bring to volume with deionized water. Wait 8-15 minutes. Read the absorbance at 578 nm.

5.0 CALCULATION

5.1 Prepare a calibration curve by plotting the absorbance value of standards versus the corresponding cyanide concentration. (per 50 mls)

$$5.2 \quad \text{CN}^- \text{ mg/l} = \frac{A \times B}{C \times D}$$

Where:

A = ug CN^- /50 mls (read from calibration curve)

B = total volume of absorbing solution from the distillation, ml. (100 mls)

C = volume or weight of original sample used in the distillation, ml or g.

D = volume of absorbing solution used in colorimetric test, ml.

6.0 INTERFERENCES

6.1 Oxidizing agents, such as chlorine, decompose most cyanides. Test by placing a drop of sample on a strip of KI starch paper previously moistened with acid. If bluish color develops, add 0.1 ascorbic acid/L sample and retest. Sodium thiosulfate can be used in place of ascorbic acid. Note: Discoloration of sample is normal when ascorbic acid is used.

CYANIDE, TOTAL BY DISTILLATION
(continued)

- 6.2 Sulfides adversely affect the colorimetric and the titration procedures. Samples that contain hydrogen sulfide, metal sulfides or other compounds that may produce hydrogen sulfide during the distillation should be treated. If a drop of the distillate on lead acetate test paper indicates the presence of sulfides, treat 25 ml more of the sample than that required for the cyanide determination with powdered cadmium carbonate. Yellow cadmium sulfide precipitates if the sample contains sulfide.

Repeat this operation until a drop of the treated sample solution does not darken the lead acetate test paper. Filter the solution through a dry filter paper into a dry beaker, and from the filtrate, measure the sample to be used for analysis.

Avoid a large excess of cadmium and a long contact time in order to minimize a loss by complexation or occlusion of cyanide on the precipitated material. Sulfides should be removed prior to preservation with sodium hydroxide as described in 2.3.

- 6.3 Carbonate in high concentrations may affect distillation by causing excessive gassing during acid addition.
- 6.4 Some sulfur compounds may decompose during distillation, releasing elemental S, H_2S or SO_2 . If this is suspected, add 50 mg of $PbCO_3$ to the absorption solution before distillation. Filter sample before proceeding with the colorimetric determination.
- 6.5 High results may be obtained for samples that contain nitrate and/or nitrite. During the distillation, nitrate and nitrite will form nitrous acid, which will react with some organic compounds to form oximes. These compounds once formed will decompose under test conditions to generate HCN. The possibility of interference of nitrate and nitrite is eliminated by pretreatment with sulfamic acid.

CYANIDE, TITRIMETRIC METHOD

1.0 SUMMARY OF METHOD

- 1.1 Cyanide is titrated with standard silver nitrate to form the soluble cyanide complex, $\text{Ag}(\text{CN})_2^-$. The excess of Ag^+ is detected by the silver-sensitive indicator, p-Dimethylaminobenzalrhodanine, which immediately turns from a yellow to a salmon color.
- 1.2 Reference: Method 412C, Standard Methods for the Examination of Water and Wastewater, 16th edition.

2.0 REAGENTS

- 2.1 Indicator Solution: Dissolve 20 mg p-Dimethylaminobenzalrhodanine in 100 ml acetone.
- 2.2 Silver Nitrate Titrant: Dissolve 3.27 g AgNO_3 in 1 L distilled water.
- 2.3 10% Sodium Hydroxide Solution.

3.0 PROCEDURE

- 3.1 Dilute high cyanide sample 1:10 in a graduated cylinder with deionized (DI) water, and use a 1 ml aliquot for titration.
- 3.2 Take a measured aliquot of sample, adjust to 100 mls with DI water in a 250 ml erlenmeyer flask containing 1 ml of 10% NaOH.
- 3.3 Add 12 to 15 drops of indicator solution to flask.
- 3.4 Titrate the solution with AgNO_3 until the solution turns a faint salmon color.

4.0 CALCULATIONS

- 4.1 1.00 ml of AgNO_3 is equivalent to 1 mg cyanide, or 1000 ug.

$$\text{CN}^- \text{ ppm} = \frac{(\text{mls of titrant}) \times \text{df} \times 1000 \text{ ug/ml}}{\text{mls of sample}}$$

Note: df = 10 for high cyanide samples.

Note: If sample turns color with one drop, re-titrate using 2-5 mls of 1:10 dilution in step 3.2, where:

$$\text{df} = \frac{10}{\text{mls used}}$$

PCB ANALYSIS

1.0 SUMMARY OF METHOD

- 1.1 Polychlorinated Biphenyls (PCB's) are extracted from liquid and solid samples with hexane. The diluted sample is injected into a gas chromatograph for separation of the PCB isomers. Several clean-up techniques can be used for samples containing interferences.
- 1.2 Reference: Modification of methods from the following:
 - 1) EPA 600/4-81-045, "The Determination of Polychlorinated Biphenyls in Transformer Fluid and Waste Oils."
 - 2) Method 8080, Test Methods for Evaluating Solid Waste SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986.
 - 3) US EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-media, Multi-concentration, 7/85 Revision

2.0 APPARATUS

- 2.1 Gas Chromatograph with an Electron Capture Detector (ECD).
- 2.2 Gas Chromatographic Column - J & W Scientific DB-5 or DB - 1701 megabore column.

3.0 REAGENTS

- 3.1 Concentrated Sulfuric Acid, A.C.S.
- 3.2 Hexane, pesticide grade.
- 3.3 Alumina, Fisher A950 or equivalent
- 3.4 Anhydrous Sodium Sulfate, granular

4.0 PROCEDURE

- 4.1 Weigh out 1 gram of sample into large test tube.
- 4.2 Add 10 ml of hexane to sample tube. Sonicate solid samples for 2 minutes at 50% power of 100 watt setting.
- 4.3 Add 3 ml of concentrated sulfuric acid (H_2SO_4) to sample tube. Shake sample tube for 2 minutes on vortex mixer.
- 4.4 Let samples settle.

PCB ANALYSIS
(continued)

- 4.5 Pipet top hexane layer of each sample into a fresh test tube. Blow down test tubes with N₂ in a hot water bath until hexane layer is reduced to 1 ml.
- 4.6 Pack chromaflex tubes with alumina and anhydrous sodium sulfate.
- 4.7 Place the 1 ml of sample from Step 4.5 onto a packed column and collect into a 10 ml volumetric flask.
- 4.8 Rinse sample test tube with 9 mls of hexane. Place this rinse onto the column.
- 4.9 After the sample and hexane rinse has passed through the column, remove the volumetric flask and bring to the volume of 10 ml.
- 4.10 Inject an aliquot of the 10 ml sample volume into gas chromatograph.

5.0 CALCULATION

- 5.1 Prepare a calibration curve by plotting the area versus the concentration for a minimum of 4 distinct peaks in each PCB Aroclor.
- 5.2 Quantitation is performed using a minimum 3 point standard curve for each peak.

$$\text{Aroclor concentration (ug/ml)} = \frac{(\text{avg ug/ml of all peaks})(10)}{\text{weight of sample}}$$

- 5.3 Total PCB concentration is the sum of the concentrations of each Aroclor found in the sample.

6.0 ACCURACY

- 6.1 A duplicate and/or spiked sample is run every 10 samples.
- 6.2 A laboratory reagent blank is run with each sample set to safeguard against contamination of glassware and reagents.
- 6.3 Continuing calibration standards are run with each sample set. Standard curves are re-calibrated when a calibration standard exhibits a detector response deviating more than 20% from its previous value.

OIL AND GREASE

1.0 SUMMARY OF METHOD

- 1.1 Dissolved or emulsified oil and grease is extracted from water by intimate contact with 1,1,2-Trichlorotrifluoroethane (Freon).
- 1.2 Reference: Method 503A, Standard Methods for the Examination of Water and Wastewater, 16th edition.

2.0 REAGENTS

- 2.1 1:1 Hydrochloric Acid, HCl
- 2.2 1,1,2-Trichlorotrifluoroethane (Freon)
- 2.3 Anhydrous Sodium Sulfate (granular)

3.0 PROCEDURE

- 3.1 Check pH of the sample. Acidify sample with HCl to $\text{pH} \leq 2$, if necessary.
- 3.2 Measure volume using graduated cylinder and transfer to separatory funnel.
- 3.3 Carefully rinse sample bottle and graduated cylinder with 30 ml freon and add solvent washings to separatory funnel.
- 3.4 Shake vigorously for 2 minutes. However, if it is suspected that a stable emulsion will form, shake gently for 5 to 10 minutes. During the first minute of shaking, stop and vent excess gas from separatory funnel before continuing.
- 3.5 Let layers separate. Drain solvent layer through a glass funnel, containing pre-rinsed, anhydrous Na_2SO_4 in a filter paper cone, into a clean, tared flask.
- 3.6 Extract twice more with 30 ml solvent each, having first rinsed graduated cylinder and sample container with each solvent portion. Combine extracts through sodium sulfate in tared flask. Rinse sodium sulfate with 5-10 mls freon.
- 3.7 Evaporate solvent from flask in a water bath at 70°C . Remove immediately when dry, evacuate flask and place on its side in the oven for 5 minutes to dry water on outside of flask.
- 3.8 Cool in a desiccator for 30 minutes and weigh.

OIL AND GREASE
(continued)

4.0 CALCULATIONS

- 4.1 If the organic solvent is free of residue, the gain in weight of the tared flask is mainly due to oil and grease.

$$\text{mg oil and grease/L} = \frac{(\text{total gain in weight}) \times 1000}{\text{L of sample}}$$

5.0 INTERFERENCES

- 5.1 Freon has the ability to dissolve other organic substances, such as sulfur compounds, certain organic dyes and chlorophyll, that are not volatilized during the test.

*Tare flask by heating in oven for at least 1 hour and cooling in desiccator for 30 minutes.

SETTLEABLE SOLIDS (SS)

The test method is described in Method 209-E, Standard Methods for the Examination of Water and Waste Water, 16th Edition, American Public Health Association,

EP TOXICITY

EP Toxicity is conducted by an outside laboratory using Extraction Procedure Test Method - Chemical Testing Methods for complying with WAC 173-303. The Extraction Procedure Test Method referenced is described in Method 1310, Test Methods for Evaluating Solid Waste, SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986.

FLASH POINT

The test method is described in Section 1010, Test Methods for Evaluating Solid Waste, SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986.

GC-MS VOLATILE SOLVENT ANALYSIS (SOLVENT SCAN)

The Solvent Scan is performed by an outside laboratory. The method is described in the following letter.

TOTAL TOXIC ORGANICS (TTO)

The TTO test is performed by an outside laboratory. The method is described in the following letter.

F-LIST AND SOLVENT ANALYSIS (F-LIST SOLVENT)

The F-List Solvent test is performed by an outside laboratory. The method is described in the following letter.



**ANALYTICAL
RESOURCES
INCORPORATED**

Analytical
Chemists &
Consultants

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**METHODS FOR ANALYSIS OF
CHEMICAL WASTE SAMPLES**

The following methods are utilized by Analytical Resources, Inc. for characterization of hazardous waste samples:

- I. Solvent Scan: A purge and trap GC-MS techniques is used to analyze for
 - Chloromethane
 - Vinyl Chloride
 - Chloroethane
 - Methylene Chloride
 - 1,1-Dichloroethene
 - 1,1-Dichloroethane
 - t-1,2-Dichloroethene
 - Chloroform
 - 1,2-Dichloroethene
 - 1,1,1-Trichloroethane
 - Carbon Tetrachloride
 - Bromodichloromethane
 - 1,2-Dichloropropane
 - t-1,3-Dichloropropene
 - Trichloroethene
 - Dibromochloromethane
 - 1,1,2-Trichloroethane
 - c-1,3-Dichloropropene
 - 2-Chloroethylvinylether
 - Tetrachloroethene
 - 1,1,2,2-Tetrachloroethane
 - Chlorobenze
 - A. Water: EPA Method 624 using sample dilution when necessary to obtain all peaks within the linear calibration range of the GC-MS system. Lower limit of detection: $\leq 10\mu\text{g/l}$.
 - B. Soil: EPA Method 8240 using only sufficient sample to give peaks within the linear range of the GC-MS or EPA-CLP (Contract Laboratory Program) Protocol for medium level VOA. This involves a MeOH extraction followed by purge and trap analysis of a portion of the MeOH extract diluted in waters. Lower limits of detection: $10\mu\text{g/kg}$ (low level); $650\mu\text{g/kg}$ (medium level).
- II. Total Toxic Organics: For samples from Chemical Processors, this parameter is defined as total concentration of Methylene Chloride, 1,1,1-Trichloroethane, Trichloroethene, Toluene, and Napthalene. The action limit for these compounds is 2.2 ppm total.
 - A. Water: The first four compounds are determined using EPA Method 624 with samples diluted 1:10. This gives a lower limit of detection approximately equal to 20 ppb. Napthalene is analyzed by GC-FID following liquid extraction of the sample with Methylene Chloride. Effective concentration is 100 to 1. Lower limit of detection for Napthalene is 10 ppb.



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Page 2 09/29/87

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III. F-list Solvent: The F-list parameters are:

<u>VOLATILES</u>	<u>DET. LIMIT MG/KG</u>	<u>SEMI-VOLATILES</u>	<u>DET. LIMIT MG/KG</u>
Methylene Chloride	20	Ethyl Acetate	50
Acetone	20	Methanol	50
1,1'-Oxybisethane	20	Isobutyl Alcohol	50
Carbon Disulfide	20	n-Butyl Alcohol	50
2-Butanone	20	Pyridine	50
1,1,1-Trichloroethane	20	2-Ethoxyethanol	50
Carbon Tetrachloride	20	Cyclohexanone	50
Trichloroethene	20	1,2-Dichlorobenzene	900
1,1,2-Trichloroethene	20	Nitrobenzene	50
Benzene	20		
4-Methyl-2-Pentanone	20		
Tetrachloroethene	20		
Toluene (Methyl Benzene)	20		
Chlorobenzene	20		
Ethyl Benzene	20		
Total Xylenes	20		
Trichlorofluoromethane	20		
1,1,2-Trichloro-			
1,2,2-trifluoroethane	20		
2-Nitropropane	N/A		

A. Volatile Compounds: EPA-CLP medium level Volatile Analysis by GC-MS. Lower limit of detection is approximately 20 ppm.

B. Semi-Volatile Compounds: Analyzed by direct aqueous injection onto carbowax GC column with Flame Ionization Detection (FIC). Lower limits of detection are given above.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE IN USED OIL BY
OXIDATIVE COMBUSTION AND MICROCOULOMETRY

1.0 SCOPE

- 1.1 This method covers the determination of total chlorine in used oil within the concentration range of 10 to 10,000 ppm chlorine.
- 1.2 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2.0 SUMMARY OF METHOD

- 2.1 The sample is placed on a quartz boat at the inlet of a high temperature quartz combustion tube. An inert carrier gas such as nitrogen, or carbon dioxide sweeps across the inlet while oxygen flows into the center of the combustion tube. The boat and sample are advanced into a vaporization zone of approximately 300° C to volatilize the light ends. Then the boat is advanced to the center of the combustion tube which is at 1000° C. The oxygen is diverted to pass directly over the sample to oxidize any remaining refractory material. All during this combustion cycle the chlorine is converted to chloride and oxychlorides, which then flow into an attached titration cell where they react with silver ions. The silver ions thus consumed are coulometrically replaced. The total current required to replace the silver ions is a measure of the chlorine present in the injected samples.

- 2.2 The reaction occurring in the titration cell as chloride enters is :



The silver ion consumed in the above reaction is generated coulometrically thus:



- 2.3 These microequivalents of silver are equal to the number of microequivalents of titratable sample ion entering the titration cell.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

3.0 INTERFERENCES

- 3.1 Other titratable halides will also give a positive response. These titratable halides include HBr and HI (HOBr + HOI do not precipitate silver). Since these oxyhalides do not react in the titration cell, approximately 50% microequivalent response is detected from bromine and iodine.
- 3.2 Fluorine does not react with silver so it is not an interferent nor is it detected.
- 3.3 This method is applicable in the presence of total sulfur concentrations of up to 10,000 times the chlorine level.

4.0 APPARATUS ¹

- 4.1 Combustion Furnace - The sample should be oxidized in an electric furnace capable of maintaining a temperature of 1000° C to oxidize the organic matrix.
- 4.2 Combustion Tube - Fabricated from quartz and constructed so that a sample, which is vaporized completely in the inlet section, is swept into the oxidation zone by an inert gas where it mixes with oxygen and is burned. The inlet end of the tube connects to a boat insertion device where the sample can be placed on a quartz boat by syringe, micropipet, or by being weighed externally. Two gas ports are provided, one for an inert gas to flow across the boat and one for oxygen to enter the combustion tube.
- 4.3 Microcoulometer - Having variable gain and bias control, and capable of measuring the potential of the sensing-reference electrode pair, and comparing this potential with a bias potential, and applying the amplified difference to the working-auxiliary electrode pair so as to generate a titrant. The microcoulometer output signal shall be proportional to the generating current. The microcoulometer may have a digital meter and circuitry to convert this output signal directly to nanograms or micrograms of chlorine or ppm chlorine.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

- 4.4 Titration cell - Two different configurations have been applied to coulometrically titrate chlorine for this method.
- a) Type I uses a sensor-reference pair of electrodes to detect changes in silver ion concentration, a generator anode-cathode pair of electrodes to maintain constant silver ion concentration and an inlet for a gaseous sample from the pyrolysis tube. The sensor, reference, and anode electrodes are silver electrodes. The cathode electrode is a platinum wire. The reference electrode resides in a saturated silver acetate half-cell. The electrolyte contains 70% acetic acid in water.
- b) Type II uses a sensor-reference pair of electrodes to detect changes in silver ion concentration, a generator anode-cathode pair of electrodes to maintain constant silver ion concentration, an inlet for a gaseous sample that passes through a 95-percent sulfuric acid dehydrating tube from the pyrolysis tube, and a sealed two-piece titration cell with an exhaust tube to vent fumes to an external exhaust. All electrodes can be removed and replaced independently without reconstructing the cell assembly. The anode electrode is constructed of silver. The cathode electrode is constructed of platinum. The anode is separated from the cathode by a 25% KNO_3 salt bridge. The sensor electrode is constructed of silver. The reference electrode is a silver/silver chloride ground glass sleeve, double junction electrode with aqueous 1M KNO_3 in the outer chamber and aqueous 1M KCl in the inner chamber.
- 4.5 Sampling Syringe - A graduated 10 ul syringe capable of accurately delivering 2 to 5 ul of sample into the sample boat.
- 4.6 Micropipet - A positive displacement micropipet capable of accurately delivering 2 to 5 ul of viscous sample into the sample boat.
- 4.7 Analytical Balance - When used to weigh the sample of 2 to 5 mg onto the boat the balance shall be accurate to ± 0.1 mg. When used to determine the density of the sample, typically 8 g per 10 ml, the balance shall be accurate to $\pm .1$ g.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.² Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.
- 5.2 Purity of Water - The water used in preparing the cell electrolyte and for bias adjustment should be demineralized or distilled or both. Water of high purity is essential.
- 5.3 Acetic Acid - Glacial acetic acid.
- 5.4 Cell Type I Reagents
 - 5.4.1 Cell Electrolyte Solution - 70% acetic acid. Combine 300 ml reagent water (5.2) with 700 ml acetic acid (5.3) and mix well.
 - 5.4.2 Silver acetate, powder purified for saturated reference electrode.
- 5.5 Cell Type II Reagents
 - 5.5.1 Sodium Acetate--Reagent grade.
 - 5.5.2 Potassium Nitrate--Reagent grade.
 - 5.5.3 Potassium Chloride--Reagent grade.
 - 5.5.4 Sulfuric Acid (concentrated)--Reagent grade.
 - 5.5.5 Agar-Reagent grade (jelly strength 450 to 600 g/cm²).
 - 5.5.6 Cell Electrolyte Solution--85 % acetic acid - Combine 150 ml reagent water (5.2) with 1.35 g sodium acetate (5.5.1) and mix well; add 850 ml acetic acid (5.3) and mix well.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

5.5.7 Dehydrating Solution--Combine 95 ml sulfuric acid (5.5.4) with 5 ml reagent water (5.2) and mix well.

CAUTION: This is an exothermic reaction and may proceed with bumping unless controlled by the addition of sulfuric acid. Slowly add sulfuric acid to water, and do not add water to sulfuric acid.

5.5.8 10 percent Potassium Nitrate--Add 10 g potassium nitrate (5.5.2.) to 100 ml reagent water (5.2) and mix well.

5.5.9 1 M Potassium Nitrate--Add 10.11 g potassium nitrate (5.5.2) to 100 ml reagent water (5.2) and mix well.

5.5.10 1 M Potassium Chloride--Add 7.46 g potassium chloride (5.5.3) to 100 ml reagent water (5.2) and mix well.

5.5.11 Agar Bridge Solution--Mix 0.7 g agar (5.5.5), 2.5 g potassium nitrate (5.5.2), and 25 ml reagent water (5.2) and heat to boiling.

- 5.6 Argon, helium, nitrogen, or carbon dioxide, high purity grade (HP)³ used as the carrier gas.
- 5.7 Oxygen, high purity grade³, used as the reactant gas.
- 5.8 Gas Regulators - Two-stage regulator must be used on the reactant and carrier gas.
- 5.9 Isooctane (2,2,4-Trimethylpentane) or toluene, reagent grade.
- 5.10 Chlorobenzene, reagent grade.
- 5.11 Chlorine, Standard Stock Solution - 10,000 ng Cl/ul
Weigh accurately 3.174 g of chlorobenzene into a 100 ml volumetric flask. Dilute to the mark with isooctane (5.9).
- 5.12 Chlorine, Standard Solution - 1000 ng Cl/ul pipet 10.0 ml of chlorine stock solution (5.11) into a 100 ml volumetric flask and dilute to volume with isooctane (5.9).

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

6.0 PREPARATION OF APPARATUS

6.1 Set up the analyzer as per the equipment manufacturer's instructions.

6.2 Typical operational conditions:

Type I

Furnace Temperature	1000° C
Carrier Gas Flow	40 cm ³ /min
Oxygen Gas Flow	160 cm ³ /min
Coulometer	
Bias	250 mV
Gain	25%

Type II

Furnace Temperature	H-1 850° C	
	H-2 1,000° C	
Carrier Gas Flow	250 cm ³ /min	
Oxygen Gas Flow	200 cm ³ /min	
Coulometer		
End Point Potential (Bias)	300 mV	
Gain	G-1	1.5 coulombs/ mV
	G-2	3.0 coulombs/ mV
	G-3	3.0 coulombs/ mV
ES-1 (range 1)	25 mV	
ES-2 (range 2)	30 mV	

NOTE: Other conditions may be appropriate. Refer to the instrument manual.

7.0A SAMPLE PREPARATION

1. Centrifuge sample to remove solid material (optional).
2. Dilute sample to be analyzed with toluene or isooctane in a ratio of 9 parts diluent to 1 part sample.
3. Shake or stir sample to mix.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

7.0B SAMPLE INTRODUCTION

1. Carefully fill a 10 ul syringe with 2 to 5 ul of sample depending on the expected concentration of total chlorine. Inject the sample through the septum onto the cool boat being certain to touch the boat with the needle tip to displace the last droplet.
2. For viscous samples that cannot be drawn into the syringe barrel, a positive displacement micropipet may be used. Here the 2 to 5 ul of sample is placed on the boat from the micropipet through the opened hatch port. The same technique as with the syringe is used to displace the last droplet into the boat. A tuft of quartz wool in the boat can aid in completely transferring the sample from the micropipet into the boat.
3. Alternatively, the sample boat may be removed from the instrument and tared on the analytical balance. A sample of 2 to 5 mg is accurately weighed directly into the boat and the boat and sample returned to the inlet of the instrument.
4. Follow the manufacturer's recommended procedure for moving the sample and boat into the combustion tube.

8.0 CALIBRATION AND STANDARDIZATION

- 8.1 System recovery, the fraction of chlorine in a standard that is titrated, should be verified every four hours by using the standard solution (5.12). System recovery is typically 85% or better.
- 8.2 Repeat the measurement of the calibration standard at least three times.
- 8.3 System Blank - The blank should be checked daily with reagent grade isooctane or toluene. It is typically less than 1 ppm chlorine. The system blank should be subtracted from both samples and standards especially if the sample contains less than 100 ppm total chlorine.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

9.0 CALCULATIONS

- 9.1 For systems which read directly in mass units of chloride, the following equations apply:

$$\text{Chlorine, ppm (wt/wt)} = \frac{\text{Display}}{(V) (D) (RF)} - B$$

or

$$\text{Chlorine, ppm (wt/wt)} = \frac{\text{Display}}{(M) (RF)} - B$$

where:

Display - Integrated value in nanograms (when the integrated value is displayed in micrograms they must be multiplied by 103)

V - Volume of sample injected in microliters

D - Density of sample in gm/cm³

RF - Recovery factor: ratio of chlorine determined in standard divided by known standard content minus the system blank, B.

$$RF = \frac{\text{Found}}{\text{Known}} - \text{Blank}$$

B - System blank in ppm Cl

$$B = \frac{\text{Display}}{(V) (D) (RF)}$$

M - Mass of sample (mg)

- 9.2 Other systems internally compensate for recovery factor, volume, density or mass and blank and thus, read out directly in ppm chlorine units. Refer to instrumentation manual.

PROPOSED ASTM TEST METHOD FOR TOTAL CHLORINE
(continued)

10.0 PRECISION AND BIAS

(To be determined by collaborative study.)

10.1 Repeatability

10.2 Reproducibility

10.3 Bias

¹Three commercial analyzers fulfill the requirements for apparatus sections 4.1 through 4.4 and have been found satisfactory for this method. They are the 2 Dohrmann Models DX-20B and MCTS-30 and Mitsubishi Model TSX-10 available from Cosa Instruments.

²"Reagent Chemicals, American Chemical Society Specifications", Am. Chemical Soc., Washington, D.C. for suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards", by Joseph Rosin, D. Van Nostrand Co., Inc., New York, N.Y. and the "United States Pharmacopeia".

³High purity grade gas has a minimum purity of 99.995%.

BRITISH THERMAL UNIT (Btu) VALUE

Btu is determined by an outside laboratory using the ASTM Method, Heat of Combustion, ASTM D-2105, 1986 Annual Book of ASTM Standards, American Testing Society for Testing Materials, 1916 Race Street, Philadelphia, PA 19103.

TEST FOR CHLORINE IN NEW AND USED PETROLEUM (BOMB METHOD)

This method is performed by an outside laboratory using the method in Appendix F, Chemical Testing Methods for Complying with the Dangerous Waste Regulation, WDOE 83-13, March 1982 (Revised July 1983 and March 1984).

DETERMINATION OF SOLIDS

1.0 SUMMARY OF METHOD

The percentage of solids is determined by several methods:

- 1) Centrifuge
- 2) Evaporation
- 3) Imhoff Cone

2.0 CENTRIFUGE PROCEDURE

2.1 Pour 10-12 ml of sample into a centrifuge tube and place in centrifuge opposite a counter balance. Centrifuge for 3-5 minutes.

2.2 Remove sample and record volume of solids.

2.3 Percent Solids = $\frac{\text{volume of solids}}{\text{volume of sample}} \times 100$

3.0 EVAPORATION PROCEDURE

3.1 Measure a sample into a tared evaporation dish.

3.2 Place dish under heat lamp on a hot plate (on low) and allow to evaporate.

3.3 Weigh dish periodically until dish weight is constant.

3.4 Percent Solids = $\frac{\text{weight solids}}{\text{weight sample}} \times 100$

4.0 IMHOFF CONE PROCEDURE

4.1 Pour sample into Imhoff Cone and allow time for the solids to settle.

4.2 Percent Solids = $\frac{\text{volume solids}}{\text{volume sample}} \times 100$

PENTACHLOROPHENOL ANALYSIS

This analysis is performed by an outside laboratory using Method 8040, Test Methods for Evaluating Solid Waste SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986.

PAINT FILTER LIQUIDS TEST

The test method is described in Method 9095, Test Methods for Evaluating Solid Waste SW-846, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, D.C. 20406, November 1986.

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

Chemical Processors, Inc. will use the TCLP procedure outlined in Appendix I to Part 268- Toxicity Characteristic Leaching Procedure (TCLP), Federal Register/Vol. 51 No. 216/Friday, November 7, 1986/Rules and Regulations.

Appendix C-3

Quality Assurance/Quality Control

Revised, May 1991

QUALITY ASSURANCE PROGRAM PLAN

CHEMICAL PROCESSORS INC.
CORPORATE LABORATORY

2203 Airport Way South
Suite 400
Seattle, WA 98134

Mel Miller, Vice President,
Engineering and Field Services

Kathy Kreps, Lab Manager & QA Officer

Date: July 1990
Revision Number: 5

TABLE OF CONTENTS

	PAGE
Introduction	1
Quality Assurance Policy Statement	2
Quality Assurance Management	4
Personnel Qualifications	7
Facilities, Equipment and Services	9
Data Generation	11
Quality Assurance Project Plans	11
Standard Operating Procedures	11
Data Processing	20
Data Quality Assessment and Corrective Action	22
Appendix I	
Current Equipment Lists	
Appendix II	
Quality Assurance Project Plan Forms	
Request for Analysis Form	
Appendix III	
Quality Assurance Project Plans	
Appendix IV	
Sample Preservation (excerpt from SW-846, 3rd Edition)	
Analysis Specific Quality Control Requirements	
Appendix V	
Chempro's Field Services Sampling Plan	
Chain of Custody Form	
Appendix VI	
Chempro's Laboratory Review System Audit Form	
Glossary	
References	

INTRODUCTION

Quality Assurance (QA) is a system for ensuring that all information, data, and resulting decisions compiled under a specific task are technically sound, statistically valid, and properly documented. Quality Control (QC) is the mechanism through which quality assurance achieves its goals. Quality control programs define the frequency and methods of checks, audits, and reviews necessary to identify problems and dictate corrective action, thus verifying data quality.

Chemical Processors, Inc. (Chempro) Corporate Laboratory conducts a QA program to achieve our goals of generating dependable data of known quality. The QA Program Plan (QAPP) is composed of management policies, data quality objectives, QA principles and standard operating procedures, designed to insure the production of quality data. This plan monitors the quality of analytical testing performed for in-house clients and for projects generated by external sources. Chempro's in-house analytical needs include analyses of discharge waters and treated waste residues awaiting off-site disposal from our Hazardous Waste Treatment Facilities, identification of unknown sample constituents, and environmental analyses of samples from sites undergoing remediation of various chemical contaminants. External sources of analytical work are generally remediation projects of varying magnitudes. When Chempro chooses contractors to perform sampling or analytical work, it will make a choice only after evaluating the contractor's QA/QC program.

QUALITY ASSURANCE POLICY STATEMENT

Chempro is committed to generating reliable analytical data of known quality. This goal is met by achieving the best precision and accuracy possible for the analytical work by routine application of standard operational procedures described in the QC plan.

Data quality objectives are either described in a specific project's Quality Assurance Project Plan (QAPjP) or they are developed and modified over time for each analysis or matrix by charting the results of quality control checks and statistically developing control and warning limits from actual laboratory historical data. Published EPA Method Control Limits are used along with the established in-house control limits.

Accuracy, precision, completeness, representativeness and comparability are all facets of overall data quality. The discussions that follow provide descriptions of these terms and how they are measured. Actual limits are omitted as these are analysis or project specific and are recorded in QAPjPs and the Chemical Processors Standard Operating Procedures (Chempro SOPs).

Accuracy is defined as the degree of agreement (nearness) of a measurement or the mean (\bar{X}) of a set of results with an accepted reference or true value. Accuracy is assessed by means of reference/spiked samples and percent recoveries.

Precision is the measure of mutual agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analyses and is best expressed in terms of the standard deviation derived under prescribed conditions.

The policy objectives for precision and accuracy are to generate data within the guidelines set forth. If the limits established for each analysis are exceeded the cause(s) of the variation are examined and corrected. The sample is rerun if necessary.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, an environmental condition or parameter variations at a sampling point. To assure that results are representative of the true field conditions QA/QC procedures are followed in the field and the laboratory. The prescribed procedures cover sampling, sample handling, chain

of custody and will provide for sample integrity until the time of analysis.

Comparability is a measure of the confidence with which one data set can be compared to another data set from the same source or for the same parameter. This is monitored by both duplicate and spiked sample analyses which must be within the limits established for each analysis or project. Another assurance of comparability is the periodic analysis of standard reference materials whose percent recoveries must fall within established in-house control limits.

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be collected under normal conditions. It is usually expressed as percentage. Although the goal for completeness varies from project to project, the overall goal for in-house samples is 100% of valid data for the required analyses. This will require resampling for a parameter if a sample breaks or is not analyzed within the prescribed holding time.

Laboratory personnel are trained by experienced Chemists/Analysts in the proper QA/QC procedures. The QAPP and the Chempro SOPs are available for constant reference by the analysts and are reviewed by each new employee.

QUALITY ASSURANCE MANAGEMENT

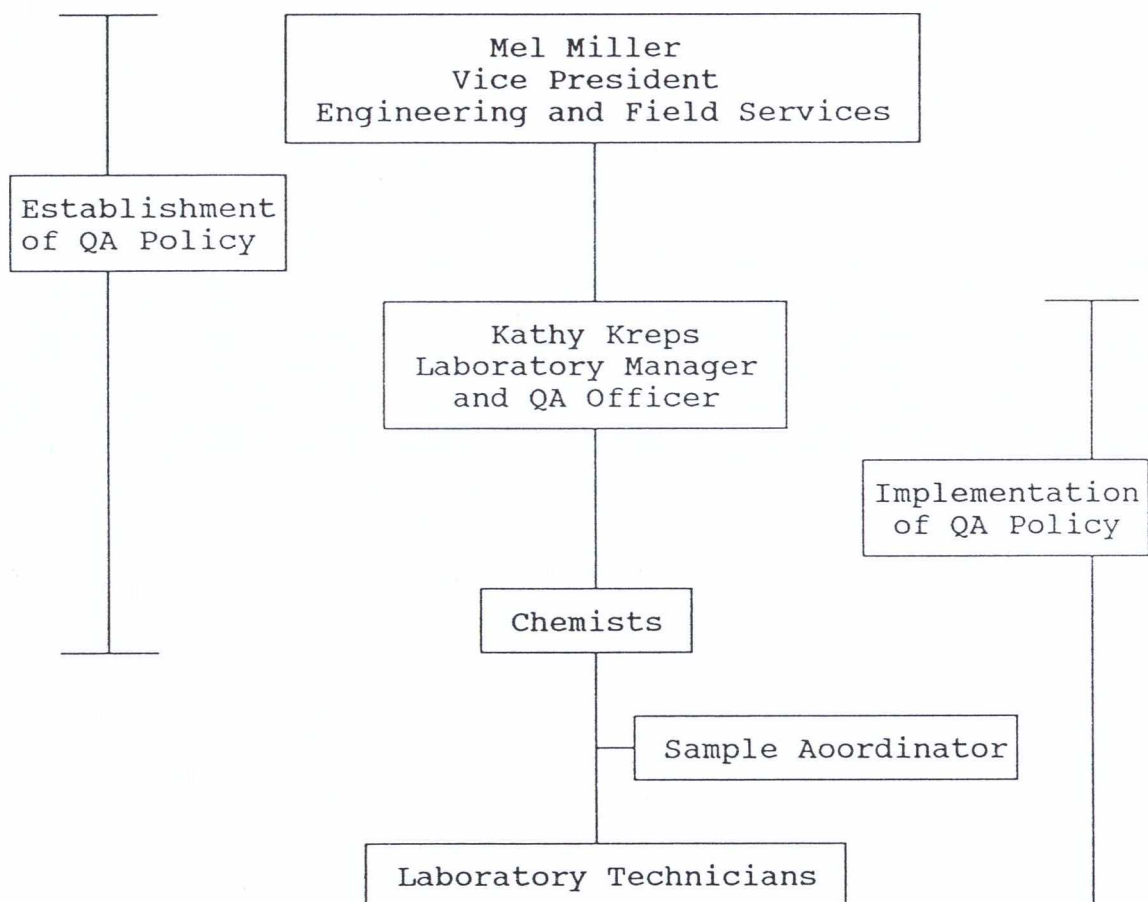
QC measures are the mechanisms used to monitor the QA program and to ensure that all data generated are meeting the program goals. QA policy is developed by the Chemists and the QA Officer. Once the QA program and specific QC procedures and standards of performance are completed, these are reviewed and approved by the Vice President, establishing the QAPP or specific QAPjP. An established QA policy is in turn implemented by the QA Officer, the Chemists and Technicians. This relationship is further described in the organizational chart shown in Fig. 1.

The overall QA responsibility for the Chempro Corporate Laboratory belongs to the Lab Manager. Chempro's QA program covers all aspects of analytical measurement from sampling methods to sample receipt and tracking, and from the analytical testing to documentation and final reporting. The QC responsibilities for each phase of sample analysis depend upon the project and are detailed in the QAPjP. As a general rule, a Field Services or Plant Supervisor assures that proper sampling, preservation and chain of custody are performed between the field and the laboratory. At the laboratory, the designated Sample Coordinator receives the samples, logs them into the lab and confirms the proper paperwork accompanies the sample. The analysts begin sample analyses within holding time limits, analyzing the appropriate QC samples along with the sample set (as specified in the Chempro SOPs or the QAPjP). The results are tabulated, entered into a computer, printed, checked for transcription errors and against any control limits for the parameter or project by the analyst who performs the work. The report is then submitted for review by a peer, supervisor and/or QA Officer who is also familiar with the project and the testing methods. This person checks the results for overall validity, transcription errors, and that QC sample results are within control limits. The report is corrected as necessary and the results are initialled and dated by the analyst and by the person who performed the QC check before being released.

The QC tracking system is a multi-phased process. QC samples are analyzed as specified in the "Analysis Specific Quality Control Requirements" table in Appendix IV. The results of these analyses are first recorded in the laboratory notebooks. These results are then transferred to analyte specific forms, formatted for blanks, duplicates, spikes and standards. The forms are filed in red three-ring binders called "QC Manuals" and are grouped in specific combinations of analytes such as metals, ions or PCB's.

Revision Number: 5
July 1990

QUALITY ASSURANCE MANAGEMENT
ORGANIZATIONAL CHART



Revision Number: 5
July 1990

Completing these forms facilitates the next step which is data entry into the computer-based QC system lotus spreadsheets following the QC System SOP. The computer then calculates relative percent difference, percent recoveries, standard deviation and control limits using equations which are included in the Glossary under the definition for each term. Results are graphed and printed for each analyte and/or matrix.

Results from QC sample analyses are tracked separately on parameter-specific computer spreadsheets. QC records of blanks are maintained manually in the QC manuals. The control limits from these records are calculated periodically and checked by the analyst and the QA Officer. Graphs of the data points and control limits for duplicates, spiked samples and check standards or Certified Reference Materials (CRMs) are updated and printed quarterly. These graphs are maintained in the QC manuals and in the Chempro SOPs. The QA Officer will meet with the analyst(s) performing the tests to discuss any discrepancies from established control limits and help to resolve any problems detected.

QA program documentation is maintained in computer spreadsheets, worksheets in notebooks, and on graphs which are updated quarterly in analysis-specific QC Manuals (which include records of the preparation and storage of standard solutions) and in the Chempro SOPs.

Results from performance and system audits are reviewed by the entire staff. Quarterly QC tables and graphs are examined by the QA Officer and submitted to the Vice President for review. Problems identified as a result of any of these reviews are examined for cause and solutions are researched and implemented. Records of audits and QC documentation are kept on file. Periodic meetings are held to review the QA program's benefits and effectiveness. The QA Officer is assigned the responsibility of ensuring that the QC measures are properly employed.

PERSONNEL QUALIFICATIONS

Chemists, analysts and technicians must be qualified to perform the responsibilities assigned to them. Qualifications include education, experience, on-the-job training and demonstrated laboratory skills. If an analyst does not have previous experience or education in using a particular instrument or performing an analytical procedure, they will go through a period of on-the-job training with a qualified analyst. The Chempro laboratory staff maintains a high level of cross training to insure a constant source of qualified personnel, and thus assure timely analytical results. Advance training to update skills in instrumentation and/or analytical methodology is pursued to increase laboratory effectiveness. Education qualifications can be substituted for experience in some cases and vice versa.

Recommended qualifications for each position held in the laboratory are set forth as follows:

Laboratory Manager/Chief Chemist:

Education: A Bachelors Degree in Chemistry or Biology or, if a Bachelors Degree in another field, a minor or minor-equivalent in Chemistry or Biology.

Experience: Eight years combined experience in environmental/analytical and hazardous waste management laboratories, with at least a one year minimum in each (understanding that some laboratories function in both capacities).

Chemist Supervisors:

Education: Same as that for a Chief Chemist.

Experience: Five years experience in environmental/analytical and/or hazardous waste management laboratories. Up to two years experience in another field of chemical laboratory can be substituted.

Chemists:

Education: Same as that for Chief Chemist or at least an A.A. Degree in Chemistry or Chemical Technology.

Experience: Three years experience in environmental/analytical and/or hazardous waste management laboratories.

Instrument Operators:

Education and experience are the same as for Chemists except for the following additional specialized training. At least one of the following: 1) Satisfactory completion of a short course offered by the equipment manufacturer or otherwise qualified training facility. 2) One to six months training under the guidance of a qualified instrument operator in-house (the time depending on which instrument and on the individual's aptitude). 3) One year previous on-the-job experience performing analyses on that type of instrument.

Technicians:

Education: High School Diploma and at least 1 year of college level coursework towards a degree in Chemistry or Biology

Experience: The technician must perform analyses under the guidance of a qualified analyst for a period of one week to two months (depending on the analysis and the aptitude of the individual). He/she must demonstrate the abilities to perform good quality work (by successfully analyzing quality control samples if appropriate) before being allowed to perform the analysis without guidance.

Any analyst performing a new procedure must do so with the direction and under the guidance of a qualified analyst until considered proficient. Courses offered by qualified training facilities should be taken to supplement in-house training as necessary. 24 hours of initial OSHA training must be completed within the first three months of employment and eight hours yearly update OSHA training each subsequent year. Training records are kept on file in the Regulatory Affairs Department.

FACILITIES, EQUIPMENT AND SERVICES

Initial facility design and all expansion designs are first examined for acceptance criteria. The layout must be an efficient usage of space, allow enough hoods for various applications and the appropriate gas, electrical, water, drain, space, surface, light, ventilation and safety requirements for all equipment used and analytical work to be performed in the laboratory.

All gas cylinders (except H₂ in use) are stored in gas storage rooms with separate oxidizer and flammable storage compartments. The gasses are piped to the benches through welded, leak-checked, "oxygen-ready" pipes which are made of a material inert to the gasses used. GC/MS gas cylinders in use are located in the immediate vicinity of the instrument. Gasses are of appropriate purity for the application and are changed when empty or when they reach a level below which contamination is suspected. Natural gas lines and lines from air compressors and vacuum pumps are piped to all locations where they are needed.

The electrical requirements of all instruments and equipment are provided for in the appropriate locations. Surge suppressors and/or dedicated electrical lines are provided as necessary for sensitive microprocessor controlled instruments, computers and integrators. Adequate benchtop and/or floor space is allowed for each anticipated piece of equipment in the laboratory design.

Hot and cold water and a deionized water spigot are located as necessary at all sinks on bench tops and cupsinks in hoods. Filters and tanks are changed as necessary on the deionized water system (indicated by ohm measuring signal lights affixed to the lines). Water connections or separate water coolers are provided for instrument cooling systems. Safety showers and eye wash stations are conveniently located and tested periodically.

The floor and benchtop surfaces were tested extensively before purchase and installation. The materials the most resistant to chemicals (especially acids and solvents) were chosen. Special care must be taken in this regard when selecting surface materials for a hazardous waste management laboratory.

Adequate lighting is provided for all storage, hood, desk, benchtop and other work areas. Ventilation is located over all instruments that require it. Most analyses where any vapors can be released are performed in hoods which are

provided in ample supply for these purposes. Hoods and vents operate 24 hours a day and spare belts are kept on hand for rapid repair.

In addition to safety showers and eye wash stations, fire extinguishers of either the halon or dry chemical variety are located conveniently throughout the lab and in each hood where natural gas is used. Lighted exit signs are posted above doors. Adequate flammable solvent, acid and alkaline storage areas are provided. In the sample storage rooms, samples are segregated by hazard class and stored on shelves with restraining bars.

Equipment is initially selected after extensive cost and productivity evaluation and hands-on testing (when possible) to determine the best unit for Chempro's analytical requirements. After receipt, an instrument is proven to function within QC specifications before being used in routine analysis.

The equipment and instruments used in Chempro's laboratory include the following:

- labware
- heaters, mixers, desiccators
- vacuum pumps, air compressors
- refrigerators, ovens
- calculators, recorders, integrators, computers
- analytical balances
- pH/selective ion meter
- AA and UV/VIS spectrophotometers
- ion and gas chromatographs
- oxidative combustion and microcoulometry

A current inventory of instrumentation is provided in Appendix I.

DATA GENERATION

The following procedures have been developed by Chempro to assure the generation of reliable data by all chemically-related measurement activities. The use of QAPjPs and Standard Operation Procedures (SOPs) will produce data that are complete, representative, comparable, and of known precision and accuracy.

Quality Assurance Project Plans

QAPjPs must be written for each specific project or continuing operation. An example of the QAPjP form used to develop these documents is included in Appendix II. The types of continuing operations for which QAPjPs currently exist (or are being developed) are listed below and included in Appendix III:

- Tacoma Discharge Samples
- Georgetown Discharge Samples
- Pier 91 Discharge Samples
- Georgetown PCB Monitoring Program
- Sales Samples
- Groundwater Monitoring
- Tacoma Stabilized Sludge Monitoring Program

A special case exists for small projects or one time samples. These are submitted to the laboratory using a Request For Analysis (RFA) form and a very brief QAPjP questionnaire intended to provide equivalent QAPjP information. Both of these forms must be completed before the corresponding samples are accepted into the laboratory. Examples of these forms are included in Appendix II.

Standard Operating Procedures

Chempro's goal of generating reliable analytical data of known quality is facilitated by adhering to the SOPs of the QC plan in the following areas.

1. Analytical Methods

An Standard Operating Procedures Manual is maintained in the laboratory which contains the actual analytical specifications for each method. It includes:

- Analytical Procedure
- Glassware
- Standards, Reagents and Solvents

Equipment
Analytical Measurements
Sample Handling and Preservation
Quality Control Requirements
Reference for the Method

Chempro's analytical methodologies are based on EPA Manual of Methods for Chemical Analysis of Water and Waste, Standard Methods for Examination of Water and Wastewater, and EPA Test Methods for Evaluating Solid Waste, SW-846. The necessary modifications are established for some parameters to suit our needs.

The combination of these guidelines form a valuable and accurate information source for, environmental samples, plant monitoring and discharge monitoring programs.

2. Glassware

The measurement of trace constituents in water and waste demands maximum sensitivity. This is especially true for metals and trace organics. Therefore, the cleanliness of the glassware and use of the volumetric ware becomes very important as part of the QA/QC program.

The method of cleaning should be adapted to both the substances that are to be removed, and the determination to be performed. Water soluble substances are simply washed out with hot or cold water, and the glassware is finally rinsed with successive small amounts of Type II water. Other substances more difficult to remove may require the use of one or more of the following: A detergent, organic solvent, dichromate cleaning solution, or inorganic acid. The glassware is then rinsed with successive amounts of tap water followed by Type II water. The analyst should be cautioned that when chromium is included in the scheme of analysis, it is imperative that the last trace of dichromate be removed from the glassware or not used at all. In all cases it is good practice to rinse glassware with tap water as soon as possible after use to prevent material from drying on glassware. As required for specific analyses, glassware is either heated in a 130°C oven, acid rinsed, or solvent rinsed prior to use. Chempro also uses disposable labware in many cases to avoid the above mentioned contamination.

3. Standards, Reagents and Solvents

Solutions and standards are prepared according to procedural specifications from analytical grade reagents, solvents and/or chemicals and Type II water. As required for trace analyses, special grades of reagents are used to reduce background interferences, insure and maintain the integrity of the analytical method and instrumentation.

Having performed the tasks of selecting, preparing, and verifying the suitability of reagents and solvents, the analyst must properly store them to prevent contamination and deterioration prior to their use. Standards, reagents and solvents must always be stored according to the manufacturer's specifications or analytical requirements. Reagents or solvents that are sensitive to light are stored in dark bottles and in a cool, dark place.

Some solutions require refrigeration or preservation. Solutions are dated when prepared if there is any possibility of deterioration over time. All solutions for use on the bench must be clearly labelled with composition, preservation and shelf life information.

Absorbents for thin-layer and column chromatography are stored in the containers that they are supplied in or according to the requirements of individual methods.

The analyst should pay particular attention to the stability of standards and reagents. Standards should not be kept longer than recommended by the manufacturer or the method. The concentration of the standards will change as a result of evaporation or deterioration. It is essential that working standards be frequently checked to determine changes in concentration or composition. When new stock solutions are necessary, dilutions of the old and new standard should be compared to determine their accuracy.

Gasses used are of the quality required for the specific analysis and are changed when cylinders are empty or at a certain pressure level below which impurities can contaminate the gas lines. Appropriate contaminant-scrubbing filters are used on gas lines as necessary and are changed before they are depleted. All gasses, reagents and chemicals are stored compatibly and safely.

4. Equipment

Each instrument operator will be responsible for the routine maintenance of that instrument. All instruments will be kept at optimum operating conditions, and checked daily for performance as detailed in this document. Instruments that do not meet requirements will not be used for further analysis until they are brought back to acceptable operating conditions. This may require retuning, column replacement, pre-column replacement, injector or source cleaning, burner head cleaning, lamp replacement, pump seal replacement, column repacking or other corrective steps before the instrument may be considered operational.

Copies of the specified limits of instrument performance will be kept with each instrument for easy reference by operators. Any personnel responsible for the operation and maintenance of any instrument will be required to know performance criteria, be able to recognize deficiencies, and demonstrate ability to correct for any difficulty.

Some pieces of ancillary equipment are relatively simple and do not require a maintenance record. These units are monitored for their performance capacities during daily usage. Malfunctioning equipment is replaced or repaired as necessary. This group of equipment includes heaters, mixers, desiccators, water baths, vacuum pumps, air compressors, calculators, recorders, printers, and integrators. Within this group some maintenance is performed but not recorded. Indicating desiccant is replaced when exhausted and the desiccator seal integrity is monitored. The water level and temperature is monitored in water baths. The oil is kept at the required level in vacuum pumps and the filters are cleaned as needed. Batteries are replaced in calculators and paper and ink/ribbon/printer heads are replaced in recorders, printers and integrators as required.

Other equipment requiring minimal but recordable monitoring includes refrigerators, ovens, computers, pH meters and analytical balances. Temperatures are recorded in log books for both ovens and refrigerators. Instrument control computers are monitored for available memory and down loaded and backed up as necessary to floppy disks or tapes which are stored. Reporting computers are backed up weekly on tape which is stored in a fire safe area. pH meters are calibrated daily and the calibration records are kept in a log book next to the instrument. Analytical balances have log books in which is recorded the dates when they are moved and/or recalibrated and periodic weighing of S-class weights.

The more complicated instruments require more thorough recordkeeping. Copies of the instrument manufacturers operating and maintenance manuals will be readily accessible to the instrument operators. The QC manuals for this equipment include, but are not limited to, the maintenance and service records, standard preparation logs and QC sample results. These are filed for laboratory personnel's usage. Calibration and performance records are also maintained.

5. Analytical Measurements

After basic elements of quality control (QC) pertaining to laboratory services, instrumentation, glassware, reagents, solvents, and gasses are followed, the analyst should insure that valid data continue to be produced. Systematic daily checks must show that the test results remain reproducible, and that the methodology is actually measuring the quantity in each sample. In addition, QC must begin with sample collection and must not end until the resulting data have been reported. QC of analytical performance within the laboratory is thus but one vital link in the dissemination of valid data to the public. Understanding and conscious use of QC among all field sampling personnel, analytical personnel, and management personnel is imperative at Chempro.

The laboratory quality assurance program includes control procedures for the following parameters:

a. Direct Quantitation

When quantitation is performed gravimetrically, spiked samples and duplicates are run periodically to assure quality. Titrants used in titrimetric analyses are standardized against solutions of known concentration as required. Standards are run periodically to monitor the titrant concentration.

b. Quantitation Using Standard Curves

A new standard curve should be established with each new batch of reagents or periodically. The curve should have at least three (3) points and cover the necessary concentration range. Samples should be quantified from the linear portion of a

curve or from within the data points in a linear least squares regression. This may require sample dilution. Calibration verification standards are analyzed every 10 samples to insure that the calibration curve is valid.

c. Quality Control Checks

In general, at least 10% of quality control (QC) samples shall be run with an analytical batch. QC samples should be analyzed as specified in the "Analysis Specific Quality Control Requirements" table in Appendix IV. A quality control sample is a:

- reagent blank
- check standard or Certified Reference Material (CRM)
- matrix spike
- matrix duplicate

In general, check standard analysis should fall within twenty (20) percent of the actual value and spiked sample analyses should fall within fifty (50) percent of actual value or these QC samples are subsequently rerun to check results. Duplicate analyses should also agree within twenty-five (25) percent or are subsequently rerun. These control limits may vary, depending on the analysis. Deviations from these limits are specified in the QC Manuals and the Chempro SOPs. Percent recovery, standard deviation and relative percent difference are calculated from the QC data on computer spreadsheets and these tabulated or graphed results are kept in the QC manuals.

6. Sample Handling and Preservation

The objective of sampling is to collect a portion of material small enough in volume to be transported conveniently and handled in the laboratory while still accurately representing the material being sampled. Field sampling is documented with specific sample identification, analysis requested, date, initials of the individual performing the sampling and methods of preservation, recording this information on a Chain of Custody (C of C), RFA, or Profile and the sample labels. The Chempro Field Services Sampling Plan is included in Appendix V. Deviations from this plan must be specifically identified in the QAPjPs.

Sample preservation includes pH control, chemical addition and/or refrigeration, and is detailed in Appendix IV. Samples requiring refrigeration are placed in a refrigerator upon receipt unless the analysis can be started immediately. Analysts are notified as soon as samples are received so rush sample analyses can be accommodated. After analysis, Chempro plant samples are returned to the generator. Other samples are held in the Chempro Corporate Laboratory sample storage area for lab packing by D.O.T. hazard class and ultimate disposal through Chempro's Georgetown facility.

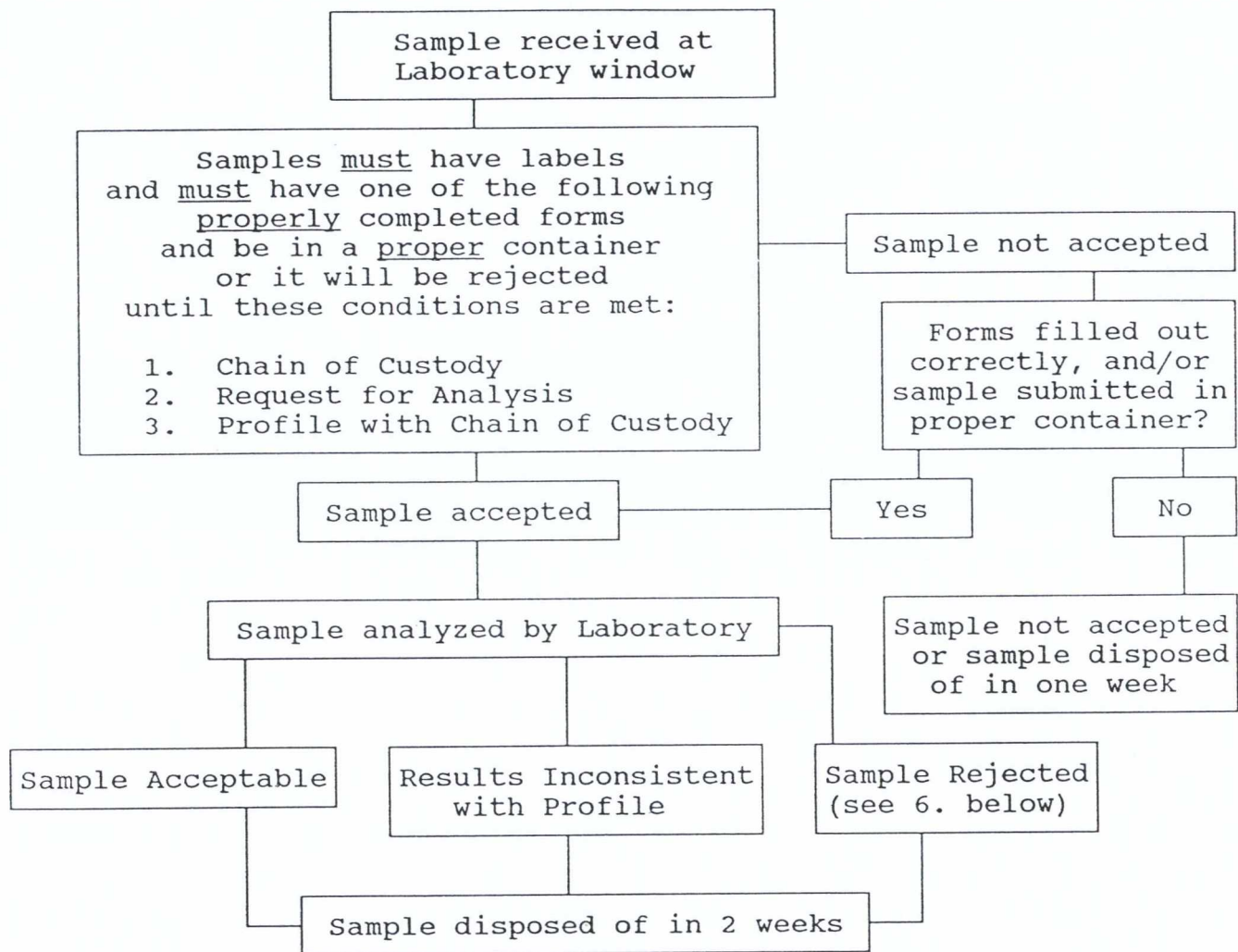
Wastewater samples requiring GC/MS analysis are transferred to the GC/MS lab. Samples which will be run shortly are put in the GC/MS hood. Samples which will be run later are put in the GC/MS VOA refrigerator. Water samples in unopened vials are held in the VOA refrigerator for 10 days before disposal or return of the sample to the generator. Other samples are held in the Chempro Corporate Laboratory sample storage area before disposal.

7. Chain of Custody

Chempro shall demonstrate the reliability of data by proving the chain of possession and custody of any sample collected and submitted to the Chempro Corporate Laboratory. There are two (2) steps in the chain of custody procedure: The transfer of samples from the field to the Chempro laboratory and/or the transfer of samples to outside laboratories. Samples must have properly completed labels and a C of C, RFA, or Profile (with attached C of C) and be in a suitable container or they will not be accepted at the Chempro Lab. Sample rejection criteria are detailed in the following chart of "Sample Receipt at Chempro Corporate Laboratory". Samples being forwarded to outside labs must be accompanied by a C of C or a Purchase Order. Consistent adherence to these guidelines should provide adequate chain of custody control for samples received at the Chempro Corporate Laboratory.

The field sampler is responsible for the custody and care of collected samples until the containers have been transferred to the custody of the laboratory or another custodian. After sample collection, the sample label and C of C, RFA, or Profile should be filled out in legible handwriting, and the bottle should be sealed in a manner which prevents tampering. Upon receipt of samples, sample labels, RFAs, C of Cs, and/or Profiles are checked for validity. Samples are initially rejected if they meet any of the rejection criteria listed in items 1-5 on the following chart of "Sample Receipt at Chempro Corporate Laboratory". Samples can be accepted once the problems with paperwork or sample

SAMPLE RECEIPT AT CHEMPRO CORPORATE LABORATORY



REJECTION CRITERIA:

1. No paperwork
2. Improper container (i.e. coffee can, tupperware, etc.)
3. Label does not contain generator name, date collected, sample description/source of sample and/or analysis requested
4. Paperwork does not contain generator name, date submitted, description/source of sample and/or analysis requested.
5. Sample is suspected of containing etiological, radioactive or explosive materials.
6. Sample does not match profile (glaring inconsistency, sufficient to cause change of D.O.T. hazard class)

containers are resolved. Samples received by the laboratory with a signed incoming C of C, RFA, or Profile are deemed to be in the custody of the laboratory. The samples are logged into the sample log book in the sample receiving area of the laboratory where sample tracking information is recorded. Each sample is given a unique lab number, which is also recorded on the paperwork and in the log book. Analysts are notified immediately when samples arrive and are provided with the appropriate paperwork. GC/MS samples are assigned a unique GC/MS number (starting with a V for VOAs) by a GC/MS analyst. Each sample to be run by GC/MS must have its own unique GC/MS number. A copy of the incoming C of C, RFA, or Profile stays with the sample. Further details on chain of custody procedures are found in Appendix V and in specific QAPjPs.

DATA PROCESSING

Samples are logged into the laboratory in a laboratory log book where sample tracking information is recorded. Each sample is given a unique lab number (also recorded on any paperwork and in the log book). All samples are submitted with either a C of C, an RFA, or a Profile. The form accompanying the sample is kept with the sample or in pending work files and is eventually filed with the sample paperwork. Samples without sufficient or complete paperwork are retained until the paperwork is completed. Samples suspected of containing etiological, radioactive, or explosive materials are rejected until such time as their contents can be proved not to contain such materials.

Data, calculations, analytical observations and results are recorded in laboratory notebooks or on sample analysis tracking forms, which are filed with reports or in three-ring binders. All pages/data entries are dated and initialled. Initialling is not necessary if the record is made in an analysts personal notebook (which is labeled and numbered by volume). Data reduction is performed and recorded in the notebooks or on the data sheets. Reduction is accomplished manually using calculators or computer spread sheets, or using the data processing abilities of instrument microprocessors which contain and reference standard curves.

An analyst's familiarity with the analysis serves as a check on microprocessor controlled calculations. In chromatography, constant review of chromatograms makes the analyst aware of computer errors caused by retention time shifts or faulty integration. Experienced spectrophotometer operators know what absorbances to expect for certain standards and what concentrations to expect for certain absorbance readings. With UV/Vis, even the degree of color of the solution acts as a flag if it does not produce the expected absorbance measurement.

Data reporting is performed using a D-Base III laboratory reporting program. For some analyses, data is transferred from the notebook to data forms for data entry into the computer system. These transfers are carefully reviewed by the analyst for accuracy before submitting them for report generation. In other cases, reports are generated directly from notebooks or sample analysis tracking forms. Reports are printed after computer input of data into the appropriate report format. These are reviewed for accuracy by the analyst. The reports are then forwarded to another analyst who understands the analytical procedures used. That analyst reviews the report for overall validity and transcription errors. The report (or corrected report) is then initialled and dated before being released. A copy of the report and any backup information is given to the generator and the original is kept on file by lab number in the laboratory.

DATA QUALITY ASSESSMENT AND CORRECTIVE ACTION

Quality control data is recorded in notebooks and on computer spreadsheets by analysis parameter. Control limits and other statistical analyses are developed from these records. The control limits are used in assessing the accuracy and precision of a sample set and the comparability of that sample set to others. Before sufficient house data is available for a certain parameter, EPA published control limits are used. In some cases, EPA published control limits are utilized regardless of in-house values. Such a case would be if a client requested a CLP QC program for sample analysis as specified in the QAPjP.

In-house generated control limits, charts, and tables are printed quarterly and reviewed by the QA Officer to monitor QA. Any deviations from the generated limits are reviewed for cause and problems are identified and solved. An evaluation of the corrective action taken and its effect is made before additional analyses are performed.

When a limit has been exceeded, the analyst must notify the QA Officer immediately if the problem cannot be readily solved. Possible causes are researched with the help of the QA Officer and other chemists and corrective action is taken. The corrective action is documented and kept on file in the appropriate QA Manual for reference when quarterly reviews of the charts are performed. Other forms of data assessment and corrective action are project specific and are detailed in the appropriate QAPjPs.

EPA WP Performance Evaluation samples, available twice a year, are analyzed for each parameter for which they are available. These results are kept on file for inspection. System Audits are performed periodically by government agencies (i.e. DOE) and private companies (relating to specific contracts). Chempro also performs in-house system audits through the Regulatory Affairs Department (see Appendix VI).

Problems identified during the Performance/System audit are examined immediately upon notification. Possible causes are identified and confirmed and solutions are developed and implemented. The QA Officer, Lab Manager and affected analysts are all involved in the investigation. The corrective action is documented and kept on file with the audit results. Once all problems identified in an audit are resolved, the complete file is made available to the Vice President for review.

APPENDIX I

CURRENT EQUIPMENT LIST

<u>QUANTITY</u>	<u>INSTRUMENT</u>
1	<u>Finnigan MAT Model Incos 50B GC/MS/DS System</u> including Tekmar LSC 2000 and ALS 2016, Varian 3400 GC, Compaq 386/20e remote terminal, 15 Mb streaming cartridge tape drive, 170 l/s turbomolecular pump, jet separator package, and Printronix and Epson dot matrix printers.
2	<u>Hewlett Packard 5890 Gas Chromatograph</u> with dual ECDs, dual packed injectors, and 7673A autosampler with dual towers.
2	<u>Hewlett Packard 5895A GC Workstation</u> is equipped with a computer terminal containing a 40 mb disk drive and accesses a 1/4" tape drive. The workstation functions in instrument control and data acquisition modes as well as data reduction and report generation modes.
1	<u>Waters Maxima Chromatography Data Station</u> is equipped with NEC 386 computer, 2 WD24 chromatography interface boards, and a NEC Pinwriter P5200 printer.
1	<u>Hewlett Packard 5710A Gas Chromatograph</u> with dual FIDs and dual packed injectors.
1	<u>Hewlett Packard 3390A Integrator</u>
1	<u>Tekmar LSC-2 Liquid Sample Concentrator</u> connected to the HP 5710A GC.
1	<u>Perkin Elmer 1100B Atomic Absorption Spectrophotometer</u> with both air/acetylene and nitrous oxide flame assemblies and D ₂ background correction.
1	<u>Perkin Elmer 5100Z Atomic Absorption Spectrophotometer</u> with Zeeman background correction, computer control, auto sampler, EDL source, and graphite furnace.
1	<u>Perkin Elmer 50 B Mercury Analyzer System</u>
various	<u>Atomic Absorption Lamps</u> , including the following: Al, As, Ba, Be, Cd, Cr, Cu, Fe, Pb, Mo, Ni, Se, Ag, Tl, V, Zn, Ca-Mg, Multi-element (Cr,Cu,Ni,Ag)

<u>QUANTITY</u>	<u>INSTRUMENT</u>
1	<u>Dionex Ion Chromatograph Series 4000i</u> with reagent delivery, advanced chromatography and eluant degas modules, potentiostat, variable wavelength detector, and Dionex 4270 integrator.
1	<u>Dohrmann Xertex Halogen Analyzer</u>
1	<u>Shimadzu UV/Vis Spectrophotometer Model 160U</u> with built in CRT, printer/plotter.
1	<u>Corning Ion Analyzer 150</u> with combination pH electrode.
1	<u>Erdco Rapid Tester</u> for closed-cup seta-flash analysis.
1	<u>Pensky-Martens Closed-cup Flash Point Tester</u>
1	<u>Radian Rotary Extractor</u>
1	<u>Tekmar Sonic Disrupter</u> with horn.
1	<u>GCA Precision Scientific Universal Centrifuge</u>
1	<u>Draeger Multi-gas Detector</u>
2	<u>Ovens</u> , VWR Model 1350 and a Blue-M.
2	<u>Balances</u> , OHAUS Models G160 and E400D.
1	<u>Muffle Furnace</u> , Thermolyne 1500.
4	<u>Refrigerators</u> , Kenmore, GE, True, Rangeaire.
1	<u>Freezer</u> , American Scientific Products
2	<u>Water baths</u> , one 8-hole concentric ring steam bath, and a VWR 1220T.
2	<u>Computers</u> , IBM XT equivalents with 1 dot matrix printer and 1 LaserJet.
1	<u>Air Compressor</u>
2	<u>Vacuum Pumps</u>
various	<u>Hot plates, Bunsen burners and magnetic stirrers.</u>

APPENDIX II

QUALITY ASSURANCE PROJECT PLAN

PROJECT NAME:
PROFIT CENTER:
ADDRESS:

RESPONSIBLE ORGANIZATION: CHEMICAL
PROCESSORS FACILITY

APPROVALS:

Project Officer: _____ Date: _____

QA Officer: _____ Date: _____

Corporate Lab Analyst: _____ Date: _____

Sample Control Center: _____ Date: _____

Regulatory Affairs: _____ Date: _____

Vice President: _____ Date: _____

PROJECT ORGANIZATION AND RESPONSIBILITY

The following is a list of key project personnel and their responsibilities:

Vice President: _____
Responsibilities: _____

Project Officer: _____
Responsibilities: _____

QA Officer: _____
Responsibilities: _____

Field/Plant Technician: _____
Responsibilities: _____

Corporate Lab Analyst: _____
Responsibilities: _____

Data Quality Review _____

System/Performance Audit _____

PROJECT CODES AND SAMPLE NUMBERS

Project Number: _____ Profit Center: _____

Labs Designated: _____ {EPA/CLP/WSDOE/Private}
_____ {EPA/CLP/WSDOE/Private}
_____ {EPA/CLP/WSDOE/Private}

Sample Numbers: assigned as received and recorded in Chempro's Corporate Laboratory Sample Log book. These sample numbers are referenced in all appropriate analytical lab notebooks, QA/QC notebooks, laboratory reports, and Permit Monitoring reports.

PROJECT DESCRIPTION

1. Objective and Scope:

2. Schedule of Tasks and Milestones:

3. Data Usage:

4. Monitoring network/sample collection design and rationale:



DATA QUALITY OBJECTIVES

1. Precision and Accuracy protocols/limits:

2. Data Representativeness:

DATA QUALITY OBJECTIVES - continued

3. Data Comparability:

4. Data Completeness:

SAMPLING PROCEDURES (including QC checks):

SAMPLE CUSTODY PROCEDURES:

CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE:

ANALYTICAL METHODS (including QC checks):

DOCUMENTATION, DATA REDUCTION AND REPORTING:

1. Documentation:

DOCUMENTATION, DATA REDUCTION AND REPORTING

- continued

2. Data Reduction and Reporting:

DATA ASSESSMENT:

PERFORMANCE/SYSTEM AUDIT:

CORRECTIVE ACTION:

REPORTS:

APPENDIX III

(Reserved)

APPENDIX IV

ANALYSIS SPECIFIC QUALITY CONTROL REQUIREMENTS

Analyte	Calibration Curve	Calibration Check Standard	Blank	Duplicate	Spike	Concentration of Standard	Concentration of Spike
PRIMARY ANALYSES:							
pH	d	m	-	-	-	pH 7	-
Cr 6 ⁺ Spot	-	w,p	b	-	-	1 ppm	-
Phenol Spot	-	w,p	b	-	-	10 ppm	-
Cyanide Spot	-	w,p	b	-	-	5 ppm	-
Cyanide (Free)	-	s ¹	-	-	-	0.2 ppm	-
<u>Metals:</u>							
TCT	b,c95%	b(EPA)	-	-	-	varies ⁵	-
Plant Discharge	b,c95%	b(EPA)	-	-	-	varies ⁵	-
SECONDARY ANALYSES:							
<u>Phenol (by distillation):</u>							
Plant Discharge & Sales Samples	c25%	b ²	b ³	b ⁴	b ⁴	0.1 mg/100 mls	1 mg
Environmental Samples	c25%	b ²	b ³	b ⁴	b ⁴	0.1 mg/100 mls	1 mg
<u>Cyanide (by distillation):</u>							
Plant Discharge & Sales Samples	c25%	b ²	b ³	b ⁴	b ⁴	1 ug/50 mls	50 ug
Environmental Samples	c25%	b ²	b ³	b ⁴	b ⁴	1 ug/50 mls	50 ug
<u>Metals:</u>							
Flame	b,c95%, c10%	b(EPA) b ⁶	- b ⁶	- -	- -	varies ⁵ varies ⁵	- -
Digestions	-	b ⁸	b ⁷	b ⁷	b ⁷	-	varies ⁵
Unknowns	-	-	-	-	b ⁹	-	varies ⁹
<u>Sulfide (by distillation):</u>							
	-	-	b ¹⁰	m ¹⁰	-	-	-
<u>Ion Chromatography:</u>							
Cr6+	c10%	b ⁶	b ⁶	w ¹¹	w ¹¹	0.1 ppm	0.1 ppm
Anions	c20%	b ⁶	b ⁶	b ⁴	b ⁴	varies	varies
PCB's ¹⁴	c25%	b ¹²	b ¹³	b ¹³	b ¹³	1.0 ppm	20 ug
Oil & Grease	-	m(EPA)	-	-	-	varies	-
Total Solids	-	-	-	b ¹⁵	-	-	-
VOA's ¹⁴	w,c30%	d	d	b ⁴	b ⁴	50 ppb	50 ppb
Total Chloride (by Dohrmann)	-	b ¹⁶	b	s	-	5 ug	-

TABLE DESCRIPTION:

Frequency is indicated as once: per month(m), per week(w), per day(d), per batch(b), per sample(s), when the calibration check standard is outside of control limits(c), when problems are suspected with the analysis(p).

Control limits are indicated for check standards, spikes and duplicates as percent recovery, as in "c20%" or as confidence interval, as in "c95%". Where no control limit is specified, the analyst should refer to the most recent update of the corresponding control chart and question the results if they are outside the 95% confidence interval warning limits.

Calibration curve is a three to five point standard curve, except for the pH meter where a two point curve is used.

Calibration check standard is used to check the validity of the curve, to standardize titrations, or to check the functioning of reagents for spot tests. Sources are indicated in parentheses where required. Percent recoveries indicated in this table may change as internal confidence intervals are established using control charts.

"Environmental samples" are water or soil samples taken during an environmental remediation or monitoring project. These projects usually have their own QC requirements associated with them and are specified in their own Quality Assurance Project Plans.

FOOTNOTES:

¹Standard analyzed with each sample which indicates positive for free cyanide.

²Mid-range standard prepared while coloring samples, not distilled.

³Taken through entire distillation procedure.

⁴Run either spike or duplicate per batch of 10 or less, or both per environmental sample matrix, whichever is greater.

⁵See Metals SOP's for concentrations of spikes and standards for each metal/analysis, and for special spiking procedures (i.e. California List Metals, Graphite Furnace Metals, TCLP(EP Tox) special QC requirements).

⁶Blank and Continuing Calibration Verification sample every 10 samples and at the end of the run.

⁷Digest a blank, duplicate and spike or a blank, spike and spike duplicate for each matrix digestion group. Sample spike recoveries should be between 75-135%, except for silver.

⁸Sample groups of 10 or more require the digestion of a standard reference material(SRM) if available or a laboratory control sample such as a spiked blank. SRM's or laboratory control sample results must be within 95% confidence intervals.

⁹Samples of unknown composition or soils with unknown levels of contamination should be run with digested spikes at both a high and a low level of analyte concentration. See Metals SOP's for suggested concentrations.

¹⁰One blank of standardized iodine solution is used per batch to standardize titrant, one duplicate (distilled) for every ten samples or once a month, whichever is greater.

¹¹One duplicate or spike every 10 samples or once a week, whichever is greater.

¹²Continuing Calibration Verification sample every 10 samples and at the end of the run.

¹³Extract a blank, duplicate or spike for every 10 samples.

¹⁴See SOP's for special QC requirements. Environmental sample requirements may differ.

¹⁵One in every 10 samples or 1 per batch, whichever is more frequent.

¹⁶Three standards are run each time the instrument is used. The average of these is used in the calculations.

APPENDIX V

APPENDIX VI

APPENDIX VI

CHEMICAL PROCESSORS, INC. LABORATORY REVIEW SYSTEM AUDIT

An on-site qualitative review of a laboratory's quality assurance systems and physical facilities for sampling, calibration, and measurement.

SAMPLE TRACKING

Log Book - including the following:

_____	Date received
_____	Time received
_____	Sample number
_____	Sample description

Sample Labels - including the following:

_____	Date collected
_____	Sampler's initials
_____	Generator's name
_____	Source of sample

Chain of Custodies - these documents must exist for all sales samples and project samples and must include the following:

_____	Date collected
_____	Generator's name
_____	Source/description of sample
_____	Sampler's signature

Sample Preservation - Are preservations and holding times within EPA guidelines? (see attached Table)

DOCUMENTATION

Lab Notebooks and Raw Data Files - should include the following:

____ Date
____ Initials of analyst or name on personal book
____ Results
____ Calculations
____ QC samples
____ Procedural modifications, if applicable

Reports - should be generated for each sample analyzed and should include the following:

____ Sample number
____ Initials of analyst
____ Reports from outside labs
____ Results, including units of measure
____ Date sample received

Project Tracking

____ Is there a method for determining if analysis has been completed in a timely fashion and which projects are in progress?

Analytical Methods

____ Is there an updated analytical methods manual available for reference by all lab personnel?
____ Does it include the following:
____ Specific QA Criteria for data validation for each method
____ Calibration procedures

Facilities, Equipment & Services

List equipment:	Operation Manual?	Maintenance Book?	Service Contract?
-----------------	----------------------	----------------------	----------------------

Is facility adequate for usage?

_____ Linear bench space/analyst
_____ Hoods (list number)
_____ Safety (see below)

_____ Fire extinguishers
_____ Safety shower
_____ Eye wash

_____ Hazardous waste storage (see below)

_____ Separately contained by hazard class?

_____ Does lab own functioning equipment sufficient to
perform analytical methods purportedly
performed?

Data Quality Assessment & Corrective Action

Quality Assurance (QA) Standard Operating Procedures (SOP's) should be available in a manual for easy reference. Are the SOP's followed?

_____ Manual
_____ SOP's followed

Examine the Quality Control notebooks for the following:

_____ Performance Audits completed satisfactorily
_____ QC samples run & recorded routinely
_____ QC limits established & followed
_____ Corrective actions

_____ QC limits exceeded
_____ System audit discrepancies
_____ Failure to adhere to a QA Program or
Project Plan or SOP'S

FOLLOW UP

If weaknesses or problems are uncovered during system or performance audits, corrective action will be initiated immediately.

Corrective action can include, but will not necessarily be limited to the following: Recalibration of instruments using freshly prepared calibration standards; replacement of lots of solvent or other reagents that gave unacceptable blank values; additional training of laboratory personnel in correct implementation of sample preparation and analysis methods; and reassignment of personnel, when necessary, to improve the overlap between operator skills and method requirements.

Whenever a long-term corrective action is necessary to eliminate the cause of nonconformance in the field or the laboratory, the following closed-loop corrective action system will be used. As appropriate, each of the following steps will be taken:

1. The problem is defined.
2. Responsibility for investigating the problem is assigned.
3. The cause of the problem is investigated and defined.
4. A corrective action to eliminate the problem is defined.
5. Responsibility for implementing the corrective action is assigned and accepted.
6. The effectiveness of the corrective action is established and the correction implemented.
7. The fact that the corrective action has eliminated the problem is verified and documented.
8. The impact on the quality of data generation is assessed.
9. A report of the corrective action is issued.

GLOSSARY OF QUALITY ASSURANCE/QUALITY CONTROL TERMS

Accuracy The degree of agreement of an analytical results with the true value. The accuracy of a result is affected by both systematic and random errors. Some writers improperly use accuracy to denote only systematic error. (See "bias")

Analyte Denotes 'that which is to be analyzed for' in chemical, but not physical or biological, determinations.

Analytical error The error, E , of an analytical results, R , is defined as

$$E = R - T$$

Analytical method where T is the true value.
Denotes a set of written instructions specifying an analytical procedure to be followed by an analyst to obtain a numerical estimate of the concentration of a determinand (analyte) in each of one or more samples.

Analytical response A numerical observation which is obtained when a portion of a sample is presented to a measurement sub-system (e.g., spectrophotometric measurement of the absorbance of a solution). The magnitude is related to the amount or concentration of the determinand (analyte) in that portion.

Analytical result Denotes a numerical estimate of the concentration of a determinand (analyte) in a sample, and is obtained by carrying out the procedure specified in an analytical method. Note that a method may specify analysis of more than one portion of a sample to produce one analytical result. The result can also be thought of as the final value reported to the user.

Analytical system Denotes a combination of analyst, analytical method, equipment, reagents, standards, laboratory facilities, any other components involved in carrying out an analytical procedure.

Batch	Batch usually refers to a set of consecutive determinations (analyses) made without interruption. The results are usually calculated from the same calibration curve or response factor. Also called a run.
Bias	The inaccuracy of an analytical result caused by systematic error.
Blank	A determination which is intended to estimate the analytical response attributable to all factors other than the determinand (analyte) in the sample. Blanks are analyzed identically to samples, but do not contain the determinand (analyte) (e.g., in water analyses, a pure water would be analyzed to determine the blank). Some writers use the term method blank with the same meaning given here for blank.
Calibration standard(s)	Solution(s) of known concentration which are used in the calibration (standardization) procedure to determine the relationship between response and concentration.
Certified reference material (CRM)	A reference material, one or more of whose property values are certified by a technically valid procedure accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.
Check standard	A solution of known concentration which is used to check the precision of analyses (and bias due to calibration). When used in conjunction with a control chart, it becomes a <u>control standard</u> .
Control limit	A type of control chart limit which is specified by a value on a control chart. If the value is exceeded, then corrective action must be taken. Control limits are usually placed at ± 3 standard deviations from the expected or mean value, and indicate a 99% confidence interval. This corresponds to EPA Performance Evaluation "Acceptance Limits"
Control chart limit	A value specified on a control chart which is used to make decisions as to whether the results or control tests are

	acceptable. Two kinds of control chart limits are usually specified: warning limits and control limits.
Criterion of detection	The smallest concentration which can be distinguished from a blank with no more than a 5% chance of reporting a false positive.
Data quality objectives (DQOs)	Qualitative and quantitative statements of the quality of data needed to support specific decisions or regulatory actions.
Degrees of freedom	A whole number expressing the amount of information available for a particular estimate; it is generally the number of independent results less the number of constraints (constraints being what else has to be estimated from the same set of results).
Determinand	Denotes 'that which is to be determined.' Covers chemical, physical, biological, or other analytical determinations.
External standard calibration	The use of independently prepared standards to determine the relationship between response and concentration. They are run separately from the sample(s). Also called external standardization.
Instrument detection limit (IDL)	Determined by multiplying by three the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of 3x-5x IDL on three nonconsecutive days with seven consecutive measurements per day.
Interference	A systematic error (bias) in the analytical result caused by the presence of a substance in the sample (or added to the sample during analysis).
Internal standardization	A calibration procedure in which the responses of analytes are determined relative to internal standard(s) which is (are) added to every sample. Two solutions - calibration and spiking - are required. Used to reduce bias due to calibration.

**Limit of detection
(or detection limit)**

The smallest concentration for which is at least a 95% chance that it will be detected as a positive (i.e., there is only a 5% chance of obtaining a false negative).

**Matrix/spike
duplicate analysis**

In matrix/spike duplicate analysis, predetermined quantities of stock solutions of certain analytes are added to a sample matrix prior to sample extraction/digestion and analysis. Samples are split into duplicates, spiked and analyzed. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level or at five times the estimated or actual method quantitation limit. When the concentration of the analyte in the sample is greater than 0.1%, no spike of the analyte is necessary.

**Method quantification
limit (MQL)**

The minimum concentration of a substance that can be measured and reported.

**Method of standard
additions (MSA)**

The addition of 3 increments of a standard solution (spikes) to sample aliquots of the same size. Measurements are made on the original and after each addition. The slope, x-intercept and y-intercept are determined by least-square analysis. The analyte concentration is determined by the absolute value of the x-intercept. Ideally, the spike volume is low relative to the sample volume (approximately 10% of the volume). Standard addition may counteract matrix effects; it will not counteract spectral effects. Also referred to as Standard Addition.

Percent recovery

That percent of a known amount of material "spiked" or added to a sample being analyzed, or known to be contained in the standard being analyzed, which is recovered at the end of analysis. See "spike" and "recovery".

$$\% \text{ Recovery} = 100 (R_2 - R_1)/A$$

where R_1 and R_2 are the results for the sample (without the spike) and the spiked

sample, respectively, and A is the equivalent concentration added in the spiked sample or the concentration of the standard.

Population	The collection of all possible analytical results.
Practical quantitation limit (PQL)	The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
Precision	A qualitative term used to denote the scatter of results. Precision is said to improve as the scatter among results becomes smaller. Also referred to as imprecision. Usually measured as standard deviation.
Quality assurance	The total integrated program for assuring the reliability of monitoring and measurement data.
Quality control (Analytical)	The routine application of statistically-based procedures to evaluate and control the accuracy of results from analytical measurements.
Random error	Indicated when repeated analyses of identical portions of a homogeneous sample does not give a series of identical results. The results differ among themselves and are more or less scattered about some value. They are termed random because the sign and magnitude of the error of any particular result vary at random, and cannot be predicted exactly.
Recovery (Analytical)	An estimate, usually expressed in percent, of an analytical result in comparison with a true or reference value for the spiked analyte or reference material, (e.g., an analytical recovery of 95% for compound X means that the result was 95 percent of the true or reference value for X in the sample). It is a direct indication of analytical performance. See "percent recovery" for the equation used in computer processing.
Recovery (Physical)	An estimate, usually expressed in percent of the amount of surrogate standard present at the final stage of analysis

(e.g., final extract), compared with the amount present in the original sample. It can be an indirect indication of analytical performance. See "percent recovery" for the equation used in computer processing.

**Reference material
(RM)**

A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

**Relative percent
difference (RPD)**

The difference between two measurements of analyte in replicate samples, expressed as a percentage of the mean of the two measurements. The equation used in computer processing is:

$$RPD = 100 |(X_1 - X_2)| / X$$

where " X_1 " and " X_2 " are the results for the sample and its replicate and " X " is the mean of the two measurements.

**Relative standard
deviation (RSD)**

The standard deviation relative to the mean. Also called 'coefficient of variation.' It is calculated as either s/x or $100s/x$. The latter is sometimes referred to as percent relative standard deviation or %RSD.

Spike

The addition of known amount of analyte to a sample for the purpose of judging, from the analytical percent recovery, whether there is bias due to interference present in the sample. Also referred to as fortification of the sample. See "Recovery (Analytical)"

Standard

A solution of known concentration. There are two types of standards: (1) check (or control), and; (2) calibration.

Standard curve

A curve which plots known concentrations of an analyte in standards versus the instrument responses to the analyte.

Standard deviation

A constant which describes the width of the normal distribution of results. An actual standard deviation is denoted by " " whereas an estimate of the standard deviation is denoted by "s". For a sample

Surrogate standard

A type of check standard, which is added to every sample in a known amount at the start of processing. The surrogate is not one of the target compounds for the analysis, but should have analytical properties similar to those compounds. The surrogate compounds are not expected to be present in environmental samples. Percent recoveries are calculated for each surrogate.

Systematic errors

Errors which are indicated by a tendency of results to be greater or smaller than the true value. Usually bias can be considered to be equivalent to systematic error.

Target compound

A compound which is expected to be in an environmental sample or for which the analysis is being conducted.

Warning limit

A type of control chart limit which is specified by a value on a control chart, usually $\pm 2s$ distant from the expected or mean value and indicates a 95% confidence interval. Action is required when results fall outside the warning limits too frequently. A single value outside a warning limit does not require action, but should alert one to a possible problem. This corresponds to the EPA Performance Evaluation "Warning Limits".

REFERENCES

EPA 600/8-83-024, June 1983, Guidelines and Specifications for Preparing Quality Assurance Program Plans, QAMS-004/80, Quality Assurance Management Staff, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, United States Environmental Protection Agency.

Handbook of Quality Assurance for the Analytical Chemistry Laboratory, James P. Dux, Ph.D., 1986.

SW-846, Third Edition, November 1986, Test Methods for Evaluating Solid Waste, Office of Solid Waste and Emergency Response, United States Environmental Protection Agency.

Draft - Procedural Manual for the Accreditation of Environmental Laboratories, Implementation of WAC 173-50, Washington State Department of Ecology.

Memorandum - Data Quality Objectives Development Process, W. Barry Towns, Region 10, Quality Assurance Management Office, United States Environmental Protection Agency.

ES & T Feature Reprint - Quality Control in Water Analysis, Cliff J. Kirchmer, Environmental Science and Technology, Vol. 17, No. 4, 1983.

of "n" replicate results taken from a population for analyses of a sample of known concentration, the estimate of the standard deviation is:

$$s = \sqrt{[(x_i - \bar{x})^2 / (n-1)]}$$

where "x" is a result and " \bar{x} " is the mean of "n" results. The equation used in computer processing is:

$$s = \sqrt{[n / (n-1)] s^2}$$

where "s" is the lotus version of standard deviation as follows:

$$s = \sqrt{[(x_i - \bar{x})^2 / n]}$$

For duplicate analyses of "m" pairs of unknown samples, the estimate of the standard deviation of the relative percent difference (d) for the two samples in each pair is:

$$s = \sqrt{[(d_i - \bar{d})^2 / (m-1)]}$$

For spike recoveries on "n" samples, the estimate of the standard deviation of the percent recovery (p) is:

$$s = \sqrt{[(p_i - \bar{p})^2 / (n-1)]}$$

Standard operating procedure (SOP)

A detailed, written description of a procedure designed to systematize the performance of the procedure.

Standard reference material (SRM)

A sample of known concentration, also called a certified reference material, issued by the National Institute for Standards and Technology (NIST).

Statistical sample

The results of one or more determinations (taken from the population of all possible results).

Statistics

Certain single values computed from the results, which characterize certain properties of the results. Each statistic has its own frequency distribution which is defined by a particular mathematical function. Examples of statistics are the mean (\bar{x}), estimate of the standard deviation (s), and the frequently-used t- and F- statistics.

APPENDIX C-4
WASTE TRACKING FORMS

CHEMICAL PROCESSORS, INC.

PROBLEM MANIFESTS PROCEDURE

Introduction

The recordkeeping system requirements specified by 40 CFR 264.72 and WAC 173-303-370 for facility operators include a section specifically for the manifest system.

The purpose of this procedure is to set criteria for manifest discrepancies, unmanifested wastes and rejecting a shipment.

A. MANIFEST DISCREPANCIES

Manifest discrepancies are significant discrepancies between the quantity or type of dangerous waste designated on the manifest or shipping paper and the quantity or type of dangerous waste a facility actually receives. Significant discrepancies in quantity are variations greater than ten percent in weight for bulk quantities (e.g., tanker trucks, railroad tank cars, etc.), or any variations in piece count for nonbulk quantities (i.e., any missing container or package would be a significant discrepancy). Significant discrepancies in type are obvious physical or chemical differences which can be discovered by inspection or waste analysis (e.g., waste solvent substituted for waste acid).

Steps to Manage a Manifest Discrepancy:

1. Operations shall contact the generator by telephone to inform the generator of the discrepancy.

PROBLEM MANIFESTS PROCEDURE
(continued)

2. Operations shall ask the generator for permission to correct the manifest to match the load. When permission is received, Operations shall make the necessary corrections and initial each correction. Any correction made will be entered on all copies of the manifest received by the facility.
3. Immediately after the corrections are entered and initialed, the discrepancy space on the manifest (No. 19) must be completed with the following information:
 - a. What the discrepancy is.
 - b. A statement to the effect that "on day/month/year (name of person contacted) gave permission to correct the discrepancy stated above."
 - c. Full signature of operations personnel correcting discrepancy and date.
4. If the load consists of drums, and the discrepancy is a type of waste, the drum must be relabeled and marked (prior to storage) to match the corrected manifest and the corrected wastestream.
5. If Operations can not reach the generator, Regulatory Affairs will be notified. Regulatory Affairs will work with Sales and Operations to insure the discrepancy is resolved within the allowed time frame of 15 days.

PROBLEM MANIFESTS PROCEDURE
(continued)

B. UNMANIFESTED LOADS

An unmanifested load, is any load delivered to the facility without a manifest or with missing information required by Generators Standards 40 CFR.

Steps to Manage an Unmanifested Load

1. Operations shall contact Regulatory Affairs immediately if a load is received without a manifest.
2. Regulatory Affairs, Operations and Sales will determine whether to accept or reject the load.
3. If the load is accepted, an unmanifested waste report form must be completed by Operations and filed with the WDOE by Regulatory Affairs.

C. Rejecting a Shipment

If a shipment arrives at one of Chemical Processors, Inc. facilities and cannot be managed properly at that facility as determined by Plant Management and Regulatory Affairs, the load shall be rejected. The generator shall be contacted by Operations, Sales or Regulatory Affairs to:

1. Notify them of the rejection.
2. To obtain instruction from the generator whether to send the shipment back to the generator or to another designated facility.

PROBLEM MANIFESTS PROCEDURE
(continued)

Examples of loads which cannot be managed properly are:

1. The waste is not listed on the respective facility's Part A Permit.
2. The load does not match the manifest, and the waste cannot be treated, stored or disposed of at that facility.

D. Unmanageable, Non-Transportable Loads

Should a shipment arrive at a Chemical Processors, Inc. Facility, which cannot be properly managed at that facility due to the reasons stated above, and the load cannot be safely transported back to the generator or to an alternate facility because it is damaged or would pose a risk to public health or the environment the following steps shall be taken:

1. Examine manifest and load to determine if the leak can be stopped with reasonable effort, time and supplies.

If the load cannot be rendered safe, implement the Emergency Preparedness, Prevention and Contingency Plan and call a clean up contractor if necessary.

2. Inform Regulatory Affairs so the proper authorities and agencies can be contacted. Notify Sales so that they can keep the generator informed.

MANIFEST
DISCREPANCY REPORT

GENERATOR: _____ DATE ____/____/____

WASTE RECEIPT #: _____ MANIFEST #: _____

WASTE TRACKING # _____

EXAMPLE



CHEMICAL PROCESSORS, INC.
2203 AIRPORT WAY SOUTH, SUITE 400
SEATTLE, WASHINGTON 98134

Chain of Custody/ Laboratory Analysis Request

DATE _____ PAGE _____ OF _____

PROJECT # _____ CLIENT INFO. _____ CONTACT _____ ADDRESS _____ TELEPHONE# _____ SAMPLERS NAME _____ PHONE# _____ SAMPLERS SIGNATURE _____					ANALYSIS REQUESTED															GENERAL CHEMISTRY (Specify)		OTHER (Specify)		NUMBER OF CONTAINERS
					BASE/NEU/ACID ORG'N. GC/MS/625/8270	VOLATILE ORGANICS GC/MS/624/8240	HALOGENATED VOLATILE ORGANICS 601/8010	PHENOLICS 604/8040	POLYNUCLEAR AROMATIC 610/8310	TOTAL ORGANIC CARBON (TOC) 415/9060	TOTAL ORGANIC HALIDE (TOX) 9020	EP TOX/TCLP METALS (Circle One)	METALS (TOTAL) As, Ba, Cd, Cr, Cu, Pb, Ni, Hg, Ag, Se, Ti, Sb, Zn	TCLP ORGANICS										
SAMPLE I.D.	DATE	TIME	LAB I.D.	TYPE																				
1.																								
2.																								
3.																								
4.																								
5.																								
6.																								
7.																								
8.																								
Relinquished By		Relinquished By		Relinquished By		PROJECT INFORMATION				SAMPLE RECEIPT														
Signature		Signature		Signature		Shipping I.D. No.				Total No. of Containers														
Printed Name		Printed Name		Printed Name		VIA				Chain of Custody Seals														
Firm		Firm		Firm		Project				Received in good condition														
Date/Time		Date/Time		Date/Time						LAB NO.														
Received By		Received By		Received By		SPECIAL INSTRUCTIONS/COMMENTS																		
Signature		Signature		Signature																				
Printed Name		Printed Name		Printed Name																				
Firm		Firm		Firm																				
Date/Time		Date/Time		Date/Time																				

DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator.

SAMPLE LABEL

CHEMICAL PROCESSORS, INC.

Date Sampled: _____ Sampled By: _____

Generator: _____ Time Sampled: _____

Source: _____

Analyze for: _____

Preservative: _____

Waste Tracking #: _____ CP #: _____

Manifest #: _____ Waste Code: _____

Laboratory #: _____

PIER EVALUATION

DATE: _____

GENERATOR: _____ WPS# _____

Sample #1 _____

F/P _____ pH _____

BS & W _____ Solids _____

Phenolics/Chrome _____

Chlorides _____

DISCHARGE MONITORING REPORT

Waste Accumulator Tank# _____ Start Gage _____ Stop Gage _____

Waste Treatment Tank# _____ Start Gage _____ Stop Gage _____

Test Results: pH _____ O&G _____ p.p.m. Odor _____ Color _____

Treatment Chemicals Used & Amount

pH Meter Checked by: _____

Date/Time	Visual Sample	pH Reading	O&G Meter Reading	Color
-----------	---------------	------------	-------------------	-------

[illegible]

CHEMICAL PROCESSORS
PIER 91

TREATMENT REPORT

DATE _____

SHIFT _____

TREATMENT: (circle) OIL CHROME PHENOL COOLANT WATER

FROM: _____

VOLUME: _____ GALS T.V.: _____

ANALYSIS	BEFORE	AFTER	CHEMICALS USED
PH	_____	_____	_____
BS&W	_____	_____	_____
PHENOL	_____	_____	_____
Cr+6	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

VOLUME AFTER TREATMENT

	GALS	TRANSFERED TO
OIL	_____	_____
WATER	_____	_____
SOLIDS	_____	_____

START TIME _____ STOP TIME _____

MAN HOURS REQUIRED _____

TREATMENT
PLAN _____

COMMENTS _____

COMPLETED _____ CONTINUED _____

IN PLANT TRANSFER SHEET

DATE : _____

START TIME : _____

STOP TIME : _____

FROM : _____

TO : _____

MATERIAL : _____

START VOLUME : _____ STOP VOLUME : _____ ACTUAL VOL. TRANS : _____

OPERATOR : _____

SHIFT : _____

COMMENTS : _____

CHEMICAL PROCESSORS, INC.
PROFILE APPROVAL FORM

Date ___/___/___

CP Number : _____
GENERATOR : _____
SAMPLE TYPE : _____

Laboratory Evaluation:

Sample Acceptable

Lab Number :

Comments :

:

:

Incoming Waste Fingerprint Analysis Required

pH	Cyanide Screen	Phenols	Sulfide	Hexavalent Chromium	Chelates
Water Reactivity	Solvent Screen	PCBs/Chlorides	Ignitability		

Date ___/___/___

Laboratory

Operations Evaluation:

Acceptable for Disposal :

Comments :

:

:

Recommended Disposition:

Georgetown	Tacoma	Washougal	Pier 91	Other
------------	--------	-----------	---------	-------

Date ___/___/___

Operations Approval

Regulatory Affairs:

Permitted to Receive	:	yes	no
Subject to 11/8/86 Land Disposal Ban	:	_____	_____
Subject to 7/8/87 Calif. Disposal Ban	:	_____	_____

Restrictions :

:

Date ___/___/___

Regulatory Affairs

CP 16818

NAME(Print): _____

SIGNATURE: _____

DATE: _____

CHEMICAL PROCESSORS
DAILY GAUGE AND INVENTORY

DATE: _____ TIME: _____ OPERATOR: _____

TANK	GAUGE HT.	ACTUAL HT.	MATERIAL	TK. COND.	LINE STATUS
					RED LINE
					WHITE LINE
					GREEN LINE
					IND LINE
					TREATMENT CHEMICALS
					FERRIC CHLORIDE _____
					CAL CHLORIDE _____
					BLEACH _____
					ALUM _____
					CAUSTIC _____
					PEROXIDE _____
					PERMANGANATE _____
					FERROUS SUL _____
					SODIUM BI SUL _____
					SULFURIC ACID _____
					SODIUM SILICATE _____
					METRO READING _____
					CITY WATER _____
					STEAM READING _____

ADDITIONAL COMMENTS: _____

CHEMICAL PROCESSORS, INC.

Pier 91
Seattle, King County
Washington 98119

WASTE RECEIPT

Nº 29045 -2

Date _____ 19__

Bill To: Name _____ P.O. _____

Address _____

Waste Generator: Name _____

Address _____

Hauler: Name _____

Waste Description	Quantity	Container		Price/Unit	Total

Comments: _____ BS & W

Chrome ☐ Pos. ☐ Neg.Phenol ☐ Pos. ☐ Neg.

pH _____

Shipper _____ Received by _____

Chemical Processors, Inc

SECTION D
PROCESS INFORMATION

SECTION D. PROCESS INFORMATION

TABLE OF CONTENTS

SECTION	PAGE
D1.0 Tank Systems	D3
D1.1 Design Specifications and Structural Integrity of Tanks	D3
D1.2 Secondary Containment Systems for Tanks	D22
D1.2.1 Design and Construction of Base	D22
D1.2.2 Containment System Capacity and Drainage Control	D24
D1.3 Tank Corrosion and Erosion Prevention	D25
D1.4 Tank and Sump Operations and Management Practices	D31
D1.5 Labeling of Tanks	D42
D1.6 Control System Design for Air Emissions from Tank Systems	D44
D1.7 Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes in Tanks	D45
D1.8 Tank Integrity Assessments	D47
D1.8.1 Existing Tank Integrity Assessment Program	D47
D1.8.2 New Tank Design and Installation	D50

LIST OF APPENDICES

Appendix D-1	Manufacturers' Data for Concrete Coating and Sealing Products
Appendix D-2	Tank Interior and Exterior Coating Material Manufacturers' Data
Appendix D-3	Design Calculations for Air Pollution Control Equipment
Appendix D-4	Secondary Containment System and Loading/Unloading Pad Designs

(LIST OF APPENDICES continued)

Appendix D-5	Secondary Containment Calculations for Tank System and Loading/Unloading Pad
Appendix D-6	Soil Study for Tank System and Loading/Unloading Pad
Appendix D-7	"Storm Drainage Study for Chemical Processors, Inc."
Appendix D-8	Design Information for Tanks
Appendix D-9	Engineering Certifications
Appendix D-10	RCRA Seismic Evaluation

LIST OF TABLES

SECTION		PAGE
D1-1	Waste Storage and Treatment Tanks	D4
D1-2a	Design Information for Tanks	D17
D1-2b	Design Information for Tank System Sumps	D21
D1-3	Summary of Secondary Containment Calculations for Tank System	D26
D1-4	Estimated Corrosion Rates of Tanks	D32
D1-5	Tank System Transfer Pump Information	D38

LIST OF FIGURES

SECTION		PAGE
D1-1	Pier 91 Facility Site Plan	D2
D1-2	Dangerous Waste Tank System and Processing Area	D5
D1-3	Tank Data Sheet - Tanks 2307-2310	D6
D1-4	Tank Data Sheet - Tank 2313	D7
D1-5	Tank Data Sheet - Tank 2701	D8

(LIST OF FIGURES continued)

SECTION		PAGE
D1-6	Tank Data Sheet - Tanks 2702, 2704	D9
D1-7	Tank Data Sheet - Tank 2703	D10
D1-8	Tank Data Sheet - Tanks 2705, 2707	D11
D1-9	Tank Data Sheet - Tank 2706	D12
D1-10	Tank Data Sheet - Tank 2708	D13
D1-11	Tank Data Sheet - Tanks 2709, 2710	D14
D1-12	Existing Dangerous Waste Area Piping and Instrumentation Diagram	D36

SECTION D. PROCESS INFORMATION

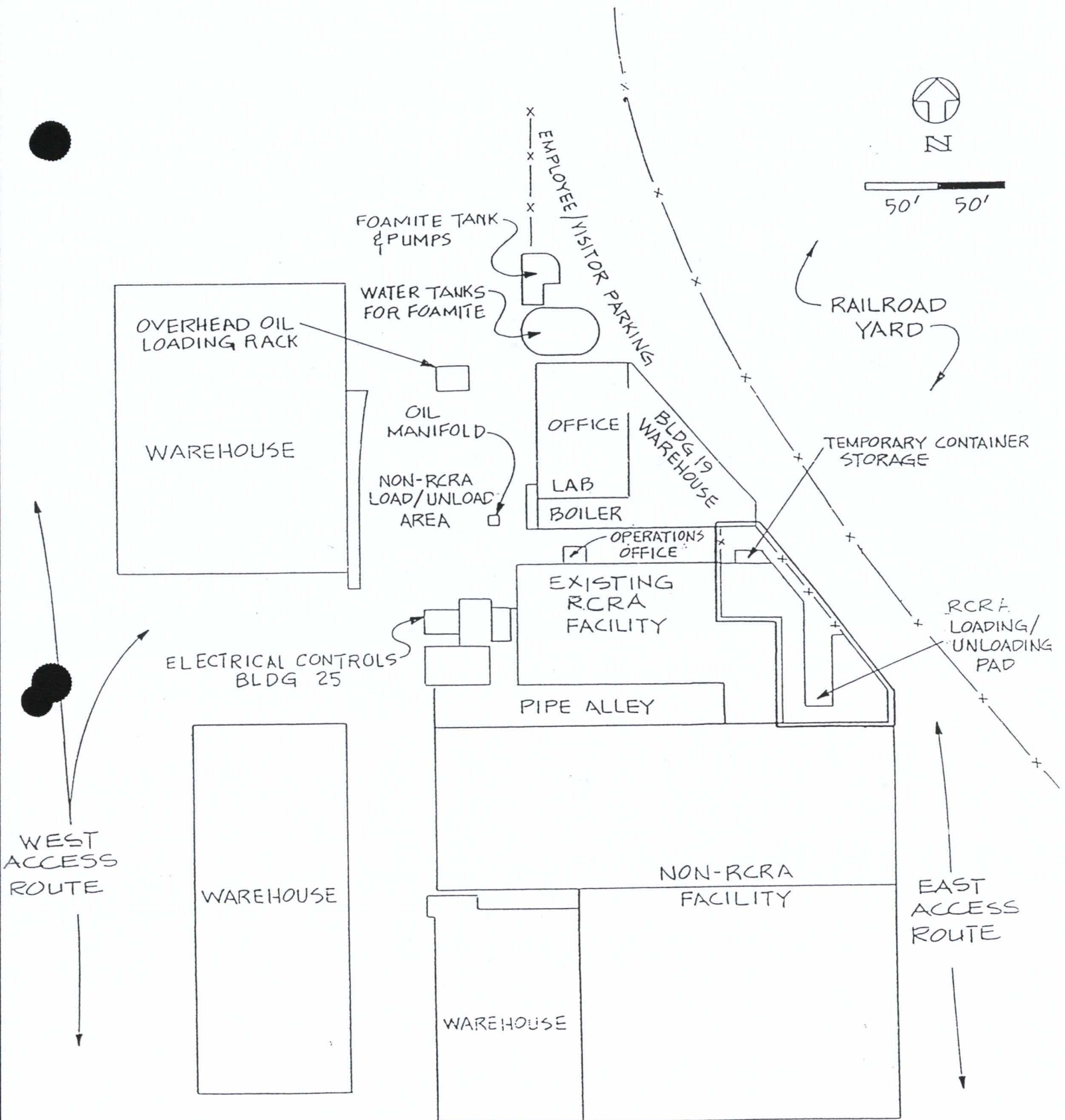
Revised, December 1990, July 1991, November 1991

WAC 173-303-630 through 670

This Process Information section provides detailed descriptions, designs, and operating information for the dangerous waste storage and treatment units at the Pier 91 Facility. The locations of dangerous waste storage and treatment areas are shown on Figure D1-1, Pier 91 Facility Site Plan.

Existing dangerous waste operations are located on a 0.5 acre portion of the facility. The existing dangerous waste (RCRA-regulated) area includes a tank system with adequate secondary containment and a centrifuge. The proposed dangerous waste (RCRA-regulated) area will be located on 0.2 acres and consist of a truck loading/unloading pad and a container storage area for temporary (90-day) storage of wastes generated on site.

Dangerous wastes are stored and treated in a tank system at the Pier 91 Facility. Wastes generated on site from tank treatment operations are stored temporarily (less than 90 days) in containers (55-gallon drums) in a separate bermed containment system. Temporary container storage is not a TSD activity and is therefore excluded from this permit application.



W. GARFIELD ST. VIADUCT

Chemical Processors, Inc.
Pier 91 Facility

**Pier 91 Facility
Site Plan**

Figure D1-1

D1.0 TANK SYSTEMS

Revised, January 1990, December 1990, November 1991

The dangerous waste tank system includes Tanks 2307 through 2710 and sumps within the area. All of these units are listed in Table D1-1, Storage and Treatment Tanks. Figure D1-1, Pier 91 Facility Site Plan, shows the locations of the existing and proposed tank systems at the facility. Figure D1-2 shows the layouts of the existing dangerous waste tank system and processing area, the proposed loading/unloading pad and the new location of the temporary container storage area.

D1.1 Design Specifications and Structural Integrity of Tanks

Revised, January 1990, July 1990, December 1990, July 1991, November 1991

40 CFR 264.191(a), (b); 264.192(a); 270.16(a), (b), (c), (e);
WAC 173-303-640(2)(a), (c), (e), & 3(a)(b); 806(4)(c)(i),
(ii), (iii), (v)

The proposed tanks within the tank system will be installed in association with issuance of the Part B permit and with changes in market, economics and/or regulations which would warrant additional storage or treatment capabilities. The tank system and ancillary equipment have adequate secondary containment and comply with WAC 173-303-640(2)(b). All of the existing and new tanks at the Pier 91 Facility are above-ground tanks; therefore, WAC 173-303-640(1)(b) is not applicable.

Tank design and operating information is provided on the Tank Data Sheets, Figures D1-4 through D1-11. These sheets also specify the intended use of the tank and the type of

TABLE D1-1. WASTE STORAGE AND TREATMENT TANKS

Revised, Jan 1990, Jul 1990, Sep 1990, Dec 1990, Jul 1991, Nov 1991

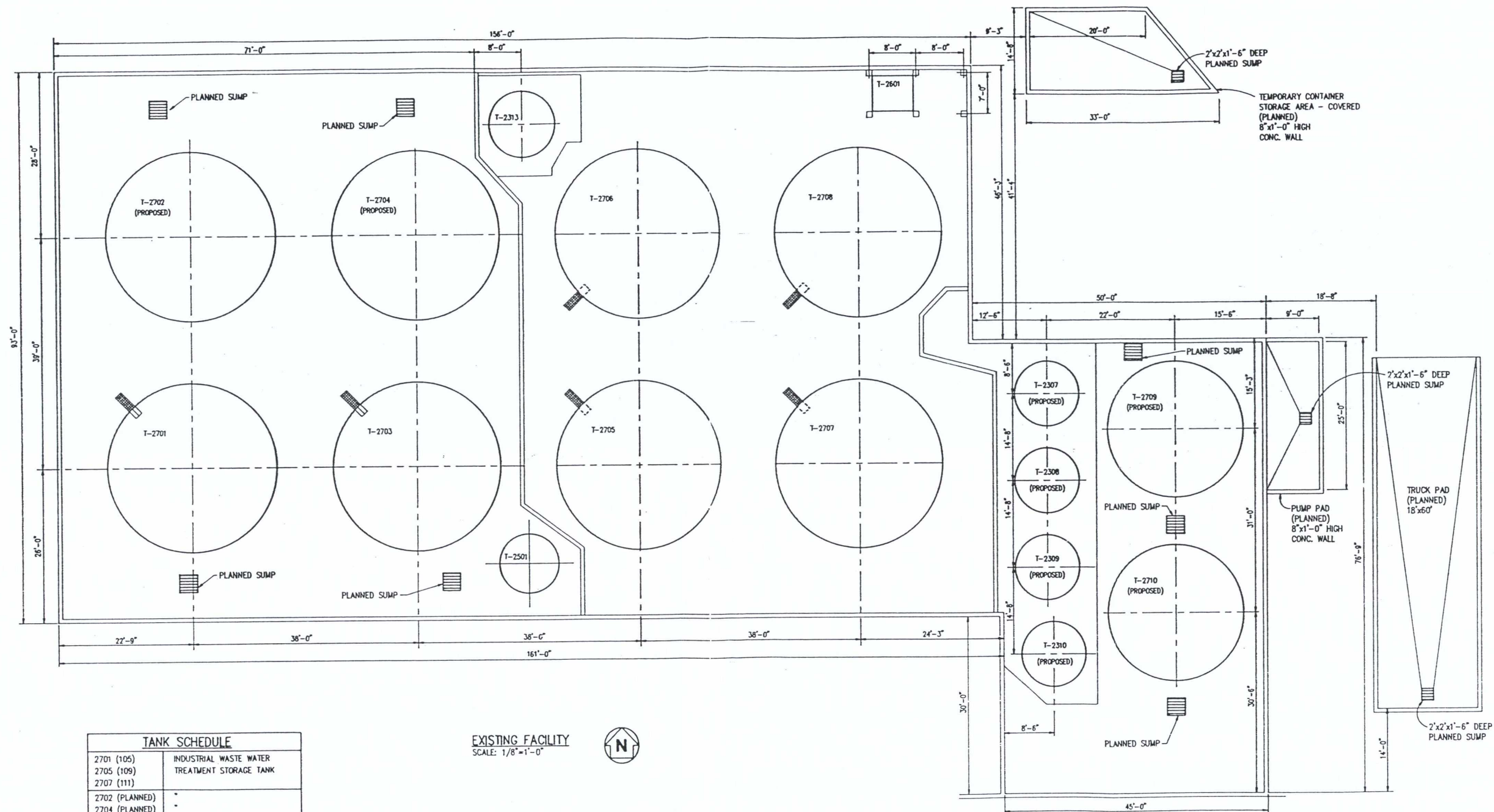
TANK NO.	TANK NAME/USAGE	STATUS	WORKING VOLUME (GAL) PER TANK	TOTAL VOLUME (GAL) PER TANK
2307, 2308, 2309, 2310	Heated Treatment/ Storage	Planned	14,100 ea.	14,810 ea.
2313	Heated Treatment/ Storage	Existing (Formerly tank 164)	14,100	14,810
2501	Treatment Chemical Storage (not RCRA- regulated)	Existing	5,287	5,874 ⁽¹⁾
2701, 2705, 2707	Industrial Waste Water Treatment/ Storage	Existing (Formerly tanks 105, 109, & 111)	44,657 ea.	49,485 ea.
2702, 2704	Industrial Waste Water Treatment/ Storage	Planned	91,727 ea.	96,555 ea.
2703 2708	Waste Oil Treatment/ Storage Tank	Existing (Formerly tanks 107, 112)	44,657 ea.	49,485 ea.
2706	Oil/Coolant Treatment and Storage	Existing (Formerly tank 110)	44,657 ea.	49,485 ea.
2709, 2710	Waste Oil Storage	Planned	52,832 ea.	55,940 ea.

EXISTING TANK STORAGE CAPACITY = 311,720 GAL

PLANNED TANK STORAGE CAPACITY = 364,230 GAL

TOTAL TANK STORAGE CAPACITY (S02) = 675,950 GAL

(1) Tank capacity not included in total for maximum waste inventory
for reason indicated in parentheses.



TANK SCHEDULE	
2701 (105)	INDUSTRIAL WASTE WATER TREATMENT STORAGE TANK
2705 (109)	
2707 (111)	
2702 (PLANNED)	"
2704 (PLANNED)	"
2703 (107)	WASTE OIL TREATMENT/STORAGE TANK
2708 (112)	
2706 (110)	OIL/COOLANT TREATMENT AND STORAGE TANK
2709 (PLANNED)	WASTE OIL STORAGE TANK
2710 (PLANNED)	"
2313 (164)	HEATED TREATMENT/STORAGE
2307 (PLANNED)	HEATED TREATMENT AND STORAGE TANK
2308 (PLANNED)	
2309 (PLANNED)	
2310 (PLANNED)	
2501	TREATMENT CHEMICAL STORAGE (NOT RCRA-REGULATED)
2601	CENTRIFUGE

11-19-91	ADDED PUMP PAD AND TRUCK PAD
INITIAL RELEASE	
BURLINGTON ENVIRONMENTAL	
PIER 91 FACILITY - DANGEROUS WASTE TANK SYSTEM & PROCESSING AREA	
DATE: 1/8"-1'-0"	PROJECT NO: D-88-21-S2
1	1

EISI
consulting engineers
1800 West Emerson Place
Suite 200
Seattle, Washington 98199

Figure D1-3
TANK DATA SHEET
(PLANNED-RCRA)

Location Existing Dangerous Waste Area
Tank Name Heated Treatment/Storage
Tank Number 2307, 2308, 2309 and 2310

Process Description Heated Treatment (Reduction, Oxidation, Demulsification, Neutralization)
Vessel Fluid Oil & Coolant Emulsions, Industrial Waste Water
Specific Gravity ≤ 1.2 Freeboard At Working Vol., Ft. 1
Normal Operating Press., PSIG Atmospheric Temp., F 200°F

	Material	Thickness	Type
Bottom	Carbon Steel	5/16"	Conical
Shell	" "	1/4"	Cylindrical
Head (Ends)	" "	1/4"	Conical

Working Vol. USG 14,100 Insulation Foam or Batting
Nominal Vol. USG 14,810 Method of Construct. Welded Steel
Tank I.D. Ft. 11' 0" Tank Height or Length Ft. 23' 5"
Design Code Used API 650, UBC Date in Service Planned
Anchorage Bolted in Concrete, Seismic Zone 3, Wind Exposure C

Connections

Item No.	Size In.	Gasket	Description
	STD.		LADDER
	12		FLANGED NOZZLE
3	6		FLANGED NOZZLE
4	1		COUPLING (1), 1 1/2" TOE (2)
5	3		FLANGED NOZZLE (9) PLCS.
6	2		" " (2 REQ'D)
7	2		" " (3 REQ'D)
8	4		" "
9	8		" "
10	24		MANWAY
11	2		FLANGED NOZZLE (2 REQ'D)
12	3		" "
13	3		FLANGED VALVE
14	3		HOSE CONNECTION
15	3/8x4		FLAT BAR (4 @ 90°)
16	10		BAFFLE (4 @ 90°)

Interior Coating High solids epoxy

Exterior Coating Polyurethane Enamel

Tank To Be Selected (See Section D1.1)

Manufacturer

MARKS:

Refer to drawing 43005

Tank Sketch

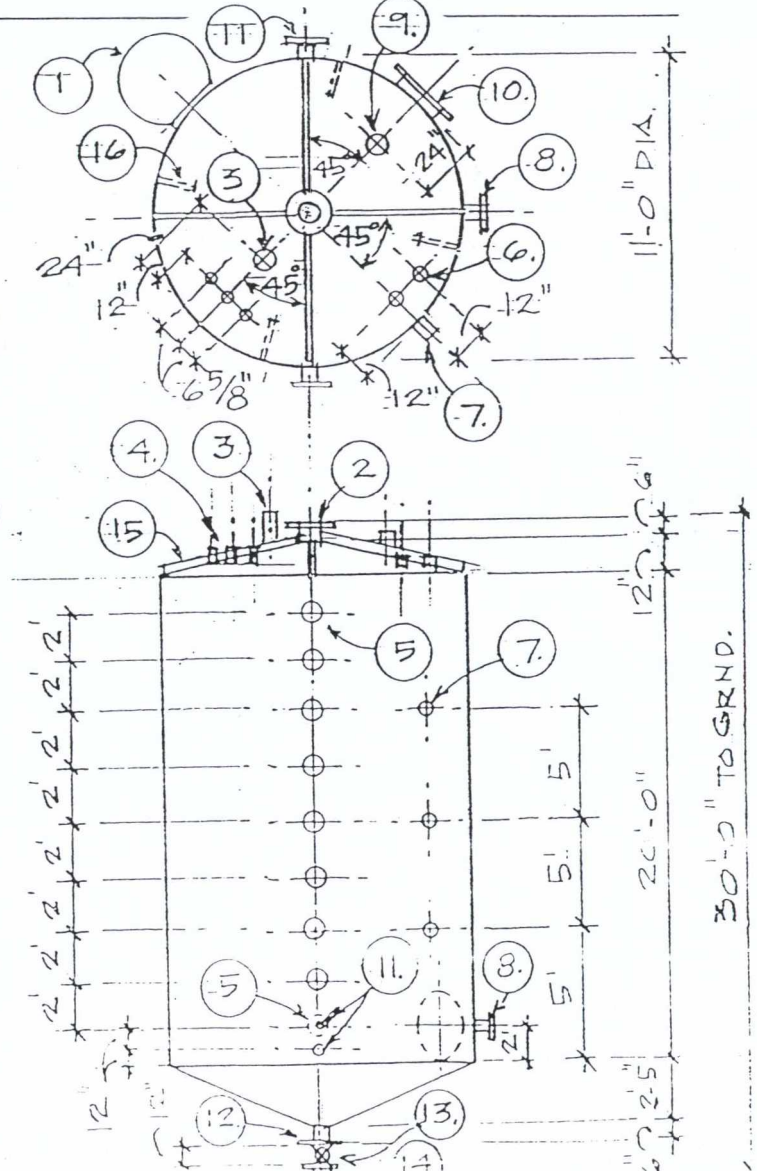


Figure D1-4
TANK DATA SHEET
(EXISTING-RCRA)

Location Existing Dangerous Waste Area
Tank Name Heated Treatment/Storage
Tank Number 2313 (164)

Process Description Heated Treatment (Reduction, Oxidation, Demulsification,
Vessel Fluid Oil & Coolant Emulsions, Industrial Waste Water Neutralization
Specific Gravity ≤1.2 Freeboard At Working Vol., Ft. 1', 0"
Normal Operating Press., PSIG Atmospheric Temp., F 200°F

	Material	Thickness	Type
Bottom	Carbon Steel	5/16"	Conical
Shell	" "	1/4"	Cylindrical
Head (Ends)	" "	1/4"	Conical

Working Vol. USG 14,100 Insulation Foam or Batting
Nominal Vol. USG 14,810 Method of Construct. Welded Steel
Tank I.D. Ft. 11' 0" Tank Height or Length Ft. 23' 5"
Design Code Used API 650, UBC Date in Service 1990
Anchorage Bolted in Concrete, Seismic Zone 3, Wind Exposure C

Connections

Item No.	Size In.	Gasket	Description
1	STD.		LADDER
2	12		FLANGED NOZZLE
3	6		FLANGED NOZZLE
4	1		COUPLING (1), 1 1/2" TOE (2)
5	3		FLANGED NOZZLE (9) PLCS.
6	2		" " (2 REQ'D)
7	2		" " (3 REQ'D)
8	4		" "
9	8		" "
10	24		MANWAY
11	2		FLANGED NOZZLE (2 REQ'D)
12	3		" "
13	3		FLANGED VALVE
14	3		HOSE CONNECTION
15	3/8x4		FLAT BAR (4 @ 90°)
16	10		BAFFLE (4 @ 90°)

Interior Coating None

Exterior Coating Zinc-rich Primer

Tank Reliable Steel
Manufacturer

REMARKS:

Refer to drawing; Mahan & DeSalvo S1 & S2

Tank Sketch

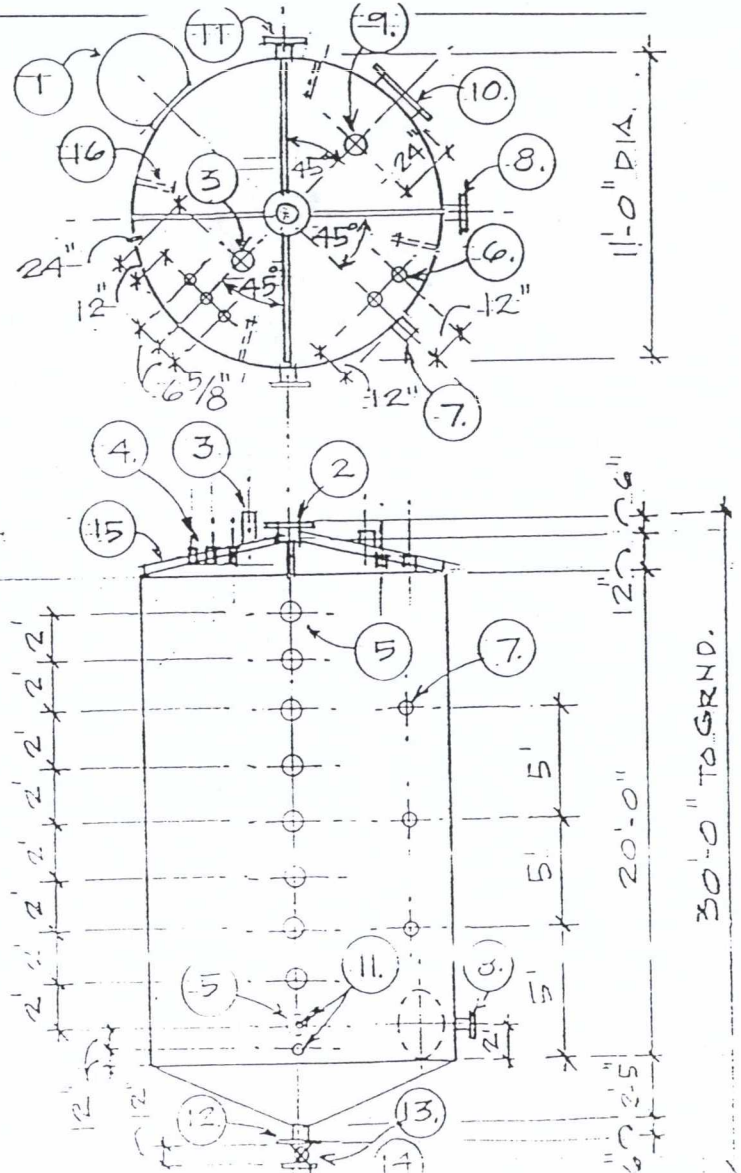


Figure D1-5
TANK DATA SHEET
(EXISTING-RCRA)

Location Existing Dangerous Waste Area
Tank Name Industrial Waste Water Treatment/Storage
Tank Number 2701 (105)

Process Description Storage/Treatment
Vessel Fluid Industrial Waste Water Contaminated with Metals/Phenolics/Oil
Specific Gravity ≤ 1.2 Freeboard At Working Vol., Ft. 1
Normal Operations Press., PSIG Atmospheric Temp., F 210

	Material	Thickness	Type
Bottom	Carbon Steel	0.25	Flat
Shell	" "	0.185	Cylindrical
Head (Ends)	" "	0.185	Cone Roof

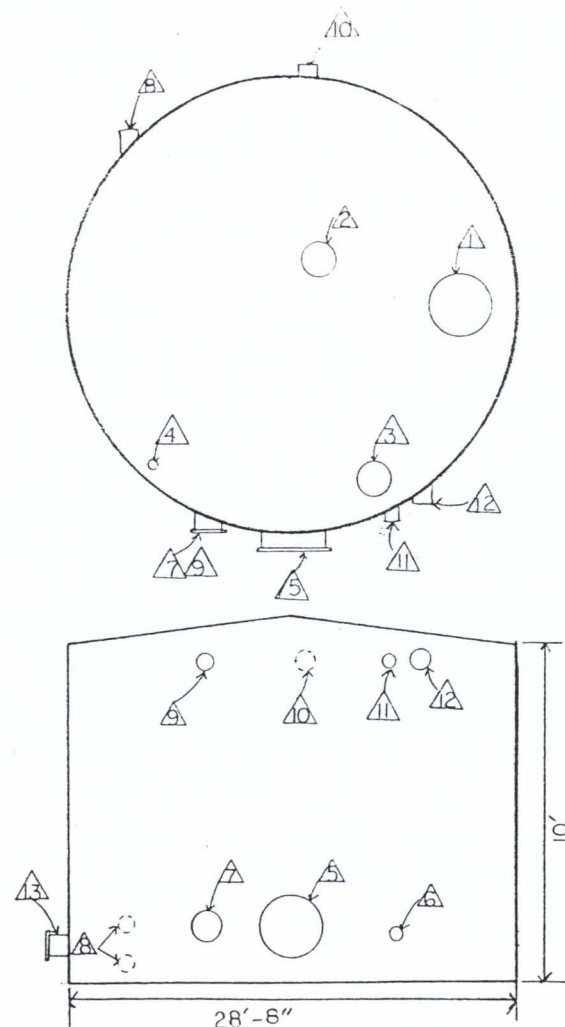
Working Vol. USG 44,657 Insulation Foam or Batting
Nominal Vol. USG 49,485 Method of Construct. Riveted
Tank I.D. Ft. 28'-8" Tank Height or Length Ft. 10'-3"
Design Code Used API 12A, API 2000, UBC Date in Service 1935 - see remarks
Anchorage Seismic Zone - 3, Wind Exposure C

Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	24		MANWAY
2	8		VENT
3	8		VENT
4	1-1/2		TEE
5	24		MANWAY
6	2-1/2		PIPE
7	6		FLANGE
8	2-1/2		PIPE
9	2-1/2		PIPE
10	3-1/2		PIPE
11	1-1/2		PIPE
12	3-1/2		PIPE
13	4		FLANGE
14			
15			

Interior Coating None
Exterior Coating Acrylic Enamel
Tank (Information Not Available)
Manufacturer



REMARKS: to be modified for secondary containment after Part B permit is issued.

Refer to drawing 40001 and 43008

Figure D1-6
TANK DATA SHEET
(PLANNED-RCRA)

Location Existing Dangerous Waste Area
Tank Name Industrial Waste Water Treatment/Storage
Tank Number 2702 and 2704
Process Description Treatment/Storage
Vessel Fluid Industrial Waste Water Contaminated with Metals/Oil
Specific Gravity ≤1.2 Freeboard At Working Vol., Ft. 1
Normal Operations Press., PSIG Atmospheric Temp., F 210

	Material	Thickness	Type
Bottom	Carbon Steel	0.5625	Flat
Shell	" "	0.3125	Cylindrical
Head (Ends)	" "	0.375	Conical

Working Vol. USG 91,727 Insulation None
Nominal Vol. USG 96,555 Method of Construct. Welded Steel
Tank I.D. Ft. 28.59 Tank Height or Length Ft. 20
Design Code Used API 650, UBC Date in Service Planned
Anchorage Bolted in Concrete, Seismic Zone 3, Wind Exposure C

Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	20		MANWAY
2	1-1/4		COUPLING
3	1		TOE
4	2		VENT
5	8		FLANGE
6	10		VENT
7	12		FLANGE
8	2		COUPLING
9	3		FLANGE (6)
10	3		FLANGE
11	1-1/2		FLANGE
12	2-1/2		FLANGE
13	30		MANWAY
14	3		FLANGE
15	3		FLANGE

16 3 FLANGE
Interior Coating High solids epoxy
Exterior Coating Polyurethane Enamel

Tank To Be Selected (See Section D1.1)
Manufacturer

REMARKS:

Refer to drawing 43006

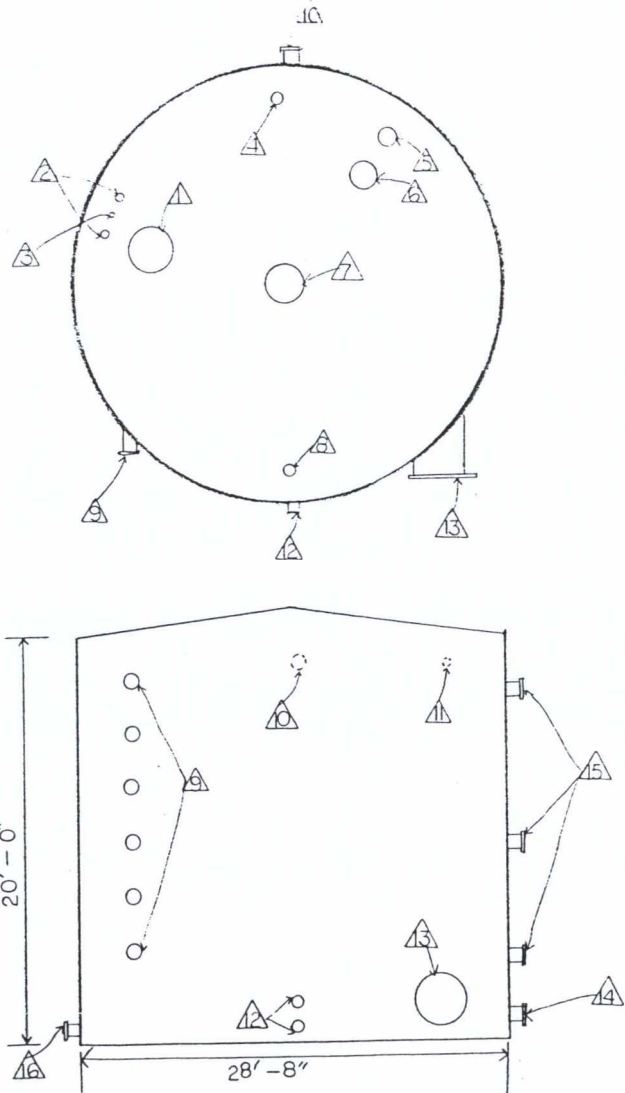


Figure D1-7
TANK DATA SHEET
(EXISTING)

Location Existing Dangerous Waste Area
Tank Name Waste Oil Treatment/Storage
Tank Number 2703 (107)

Process Description Storage/Treatment
Vessel Fluid Waste Oil Contaminated with Metals/Phenolics/Water
Specific Gravity 51.2 Freeboard At Working Vol., Ft. 1
Normal Operating Press., PSIG Atmospheric Temp., F 210

	Material	Thickness	Type
Bottom	Carbon Steel	0.25	Flat
Shell	" "	0.210	Cylindrical
Head (Ends)	" "	0.130	Cone Roof

Working Vol. USG 44,657 Insulation Foam or Batting
Nominal Vol. USG 49,485 Method of Construct. Riveted
Tank I.D. Ft. 28'-8" Tank Height or Length Ft. 10'-8"
Design Code Used API 12A, API 2000, UBC Date in Service 1935 - see remarks
Anchorage Seismic Zone - 3, Wind Exposure C

Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	24		MANWAY
2	8		VENT
3	8		VENT
4	1-1/2		TEE
5	24		MANWAY
6	2-1/2		PIPE
7	6		FLANGE
8	2-1/2		PIPE
9	2-1/2		PIPE
10	3-1/2		PIPE
11	1-1/2		PIPE
12	3-1/2		PIPE
13	4		FLANGE
14			
15			

Interior Coating None
Exterior Coating Acrylic Enamel
Tank (Information Not Available)
Manufacturer

REMARKS: To be modified for secondary containment after Part B permit is issued.

Refer to drawing 40001 and 43008

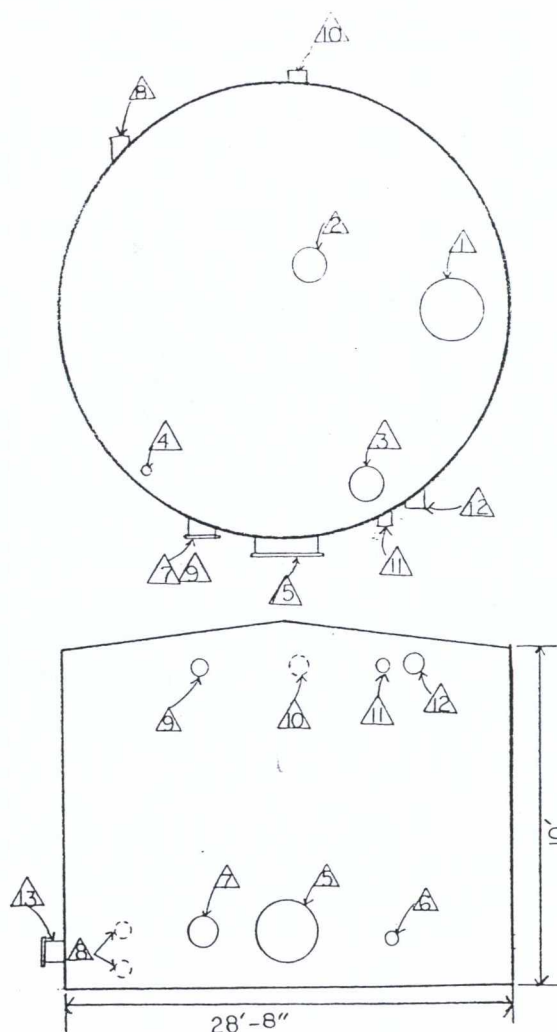


Figure D1-8
TANK DATA SHEET
(EXISTING-RCRA)

Location Existing Dangerous Waste Area
 Tank Name Industrial Waste Water Treatment/Storage
 Tank Number 2705 (109) and 2707 (111)
 Process Description Storage/Treatment
 Vessel Fluid Industrial Waste Water Contaminated with Metals
 Specific Gravity 1.2 Freeboard At Working Vol., Ft. 1
 Normal Operations Press., PSIG Atmospheric Temp., F Ambient

	Material	Thickness	Type
Bottom	Carbon Steel	0.25	Flat
Shell	" "	0.2	Cylindrical
Head (Ends)	" "	0.2	Cone Roof

Working Vol. USG 44,657 Insulation None
 Nominal Vol. USG 49,485 Method of Construct. Riveted
 Tank I.D. Ft. 28'-8" Tank Height or Length Ft. 10'-3"
 Design Code Used API 12A, API 2000, UBC Date in Service Modified 1991
 Anchorage Seismic Zone - 3, Wind Exposure C

Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	8		FLANGE (VENT)
2	24		MANWAY
3	8		FLANGE (VENT)
4	1-1/2		TEE
5	3-1/2		PIPE
6	3-1/2		PIPE
7	2-1/2		PIPE
8	24		MANWAY
9	6-1/2		FLANGE
10	4		FLANGE
11			
12			
13			
14			
15			

Interior Coating None
 Exterior Coating Acrylic Enamel
 Tank (Information Not Available)
 Manufacturer

MARKS: Modified for secondary containment per dwg 43008 in 1991.

 Refer to drawing 40002 and 43008

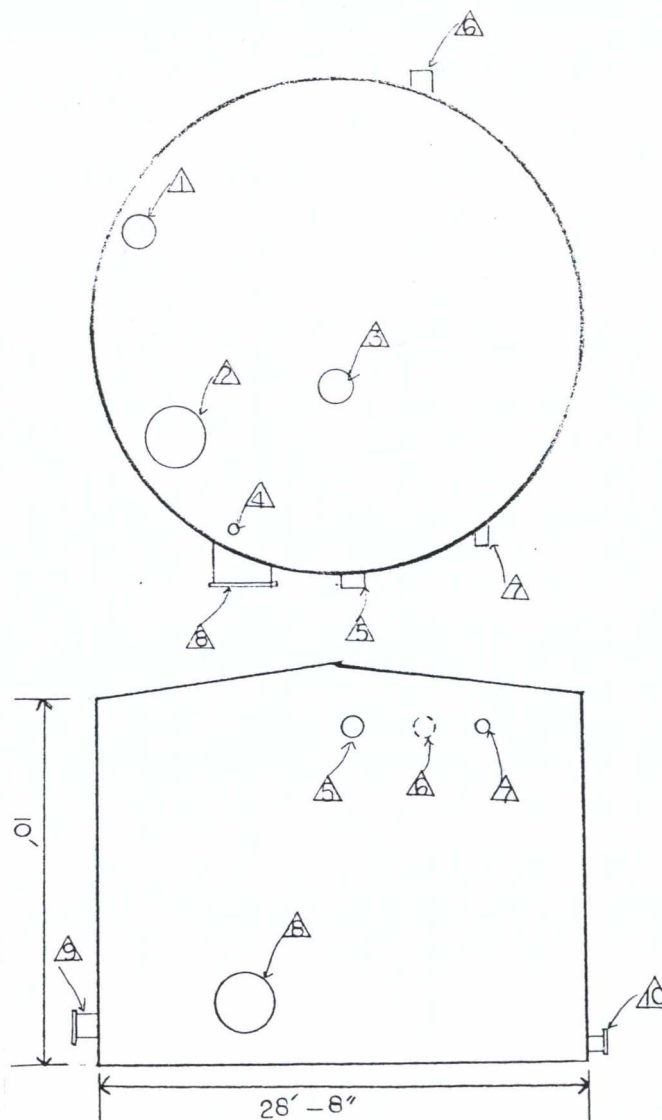


Figure D1-9

TANK DATA SHEET
(EXISTING-RCRA)

Location Existing Dangerous Waste Area
 Tank Name Oil/Coolant Treatment/Storage
 Tank Number 2706 (110)

Process Description Treatment/Storage

Vessel Fluid Oil/Coolant Emulsions - Contaminated with Metals/Phenolics

Specific Gravity ≤ 1.2 Freeboard At Working Vol., Ft. 1

Normal Operating Press., PSIG Atmospheric Temp., F 210

	Material	Thickness	Type
Bottom	Carbon Steel	0.25	Flat
Shell	" "	0.21	Cylindrical
Head (Ends)	" "	0.17	Cone Roof

Working Vol. USG 44,657

Nominal Vol. USG 49,485

Tank I.D. Ft. 28'-8"

Design Code Used API 12A, API 2000, UBC

Anchorage Seismic Zone 3, Wind Exposure C

Insulation Foam or Batting
 Method of Construct. Riveted

Tank Height or Length Ft. 10'-3"

Date in Service 1935-modified 1991

Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	8		FLANGE
2	24		MANWAY
3	1-1/2		TEE
4	8		FLANGE
5	1-1/2		PIPE
6	3-1/2		PIPE
7	3-1/2		PIPE
8	2-1/2		PIPE
9	2-1/2		PIPE
10	24		MANWAY
11	6-1/2		FLANGE
12	2-1/2		PIPE
13	4		FLANGE
14			
15			

Interior Coating High solids epoxy
 (See remarks)

Exterior Coating Acrylic Enamel

Tank (Information Not Available)

Manufacturer

REMARKS: Modified for secondary containment per dwg 43008 in 1991.

Bottom & lower 2 ft. of sheet lined
 w/high solids epoxy.

Refer to drawing 40002 43008

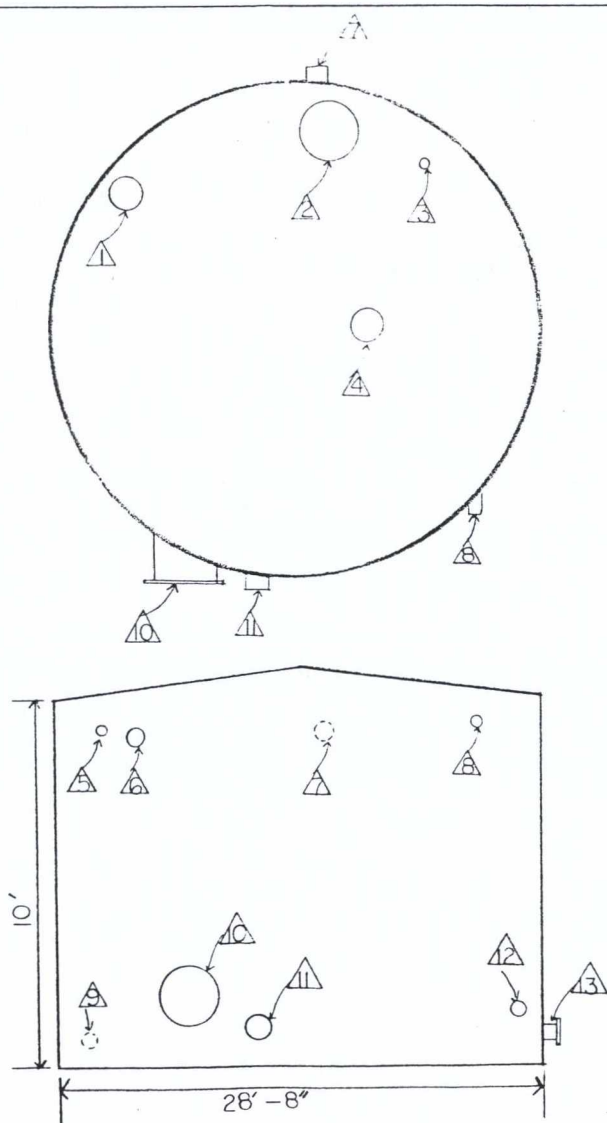


Figure D1-10
TANK DATA SHEET
(EXISTING-RCRA)

Location Existing Dangerous Waste Area
Tank Name Waste Oil Treatment/Storage
Tank Number 2708 (112)

Process Description Treatment/Storage
Vessel Fluid Waste Oil Contaminated with Metals/Phenolic/Water
Specific Gravity ≤1.2 Freeboard At Working Vol., Ft. 1
Normal Operating Press., PSIG Atmospheric Temp., F 210

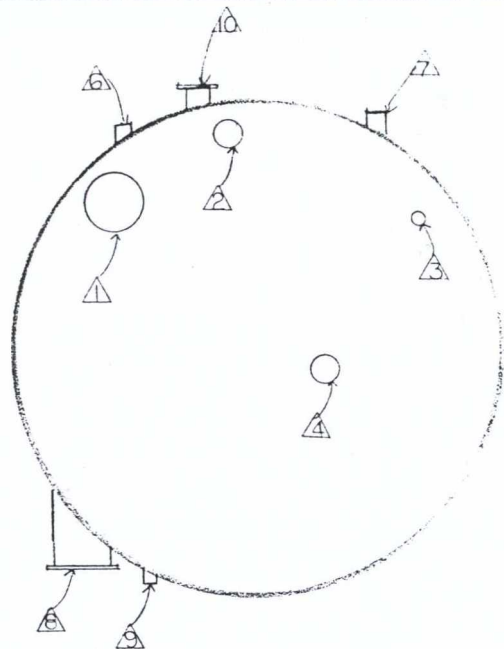
	Material	Thickness	Type
Bottom	Carbon Steel	0.25	Flat
Shell	" "	0.185	Cylindrical
Head (Ends)	" "	0.190	Cone Roof

Working Vol. USG 44,657 Insulation Foam or Battling
Nominal Vol. USG 49,485 Method of Construct. Riveted
Tank I.D. Ft. 28'-8" Tank Height or Length Ft. 10'-3"
Design Code Used API 12A, API 2000, UBC Date in Service 1935 - modified 1991
Anchorage Seismic Zone - 3, Wind Exposure C

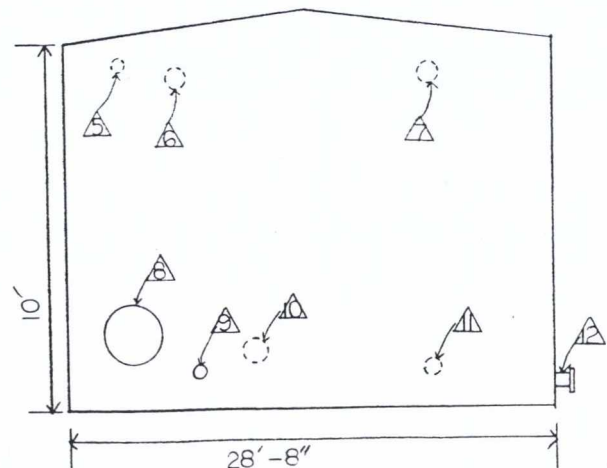
Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	24		MANWAY
2	8		FLANGE
3	1-1/2		TEE
4	8		FLANGE
5	1-1/2		PIPE
6	3-1/2		PIPE
7	3-1/2		PIPE
8	24		MANWAY
9	2-1/2		PIPE
10	6-1/2		FLANGE
11	2-1/2		PIPE
12	4		FLANGE
13			
14			
15			



Interior Coating None
Exterior Coating Acrylic Enamel
Tank (Information Not Available)
Manufacturer



MARKS: Modified for secondary containment per dwg 43008 in 1991.

Refer to drawing 40002 and 43008

Figure D1-11
TANK DATA SHEET
(PLANNED-RCRA)

Location Existing Dangerous Waste Area
 Tank Name Waste Oil Storage Tank
 Tank Number 2709 and 2710
 Process Description Storage
 Vessel Fluid Waste Oil Contaminated with Metals/Water/Phenolic
 Specific Gravity ≤1.2 Freeboard At Working Vol., Ft. 1
 Normal Operations Press., PSIG Atmospheric Temp., F 210

	Material	Thickness	Type
Bottom	Carbon Steel	0.5625	Flat
Shell	" "	0.3125	Cylindrical
Head (Ends)	" "	0.375	Cone Roof

Working Vol. USG 52,832 Insulation None
 Nominal Vol. USG 55,940 Method of Construct. Welded Steel
 Tank I.D. Ft. 23 Tank Height or Length Ft. 18
 Design Code Used API 650 , UBC Date in Service Planned
 Anchorage Bolted in Concrete, Seismic Zone 3, Wind Exposure C

Connections

Tank Sketch

Item No.	Size In.	Gasket	Description
1	20		MANWAY
2	1-1/4		COUPLING
3	1		TOE
4	2		VENT
5	8		FLANGE
6	10		VENT
7	12		FLANGE
8	2		COUPLING
9	3		FLANGE (6)
10	3		FLANGE
11	1-1/2		FLANGE
12	2-1/2		FLANGE
13	30		MANWAY
14	3		FLANGE
15	3		FLANGE
16	3		FLANGE

Interior Coating None

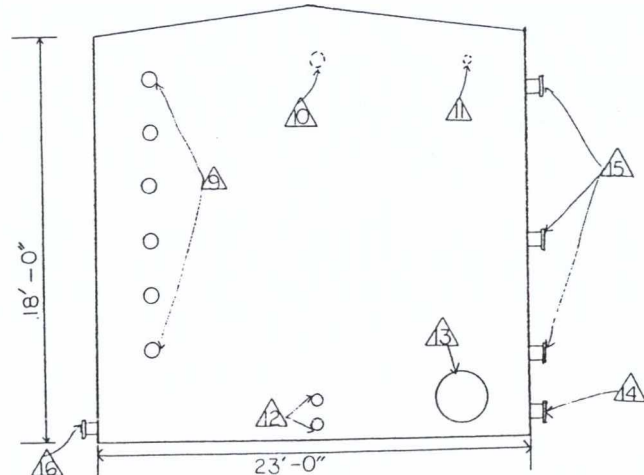
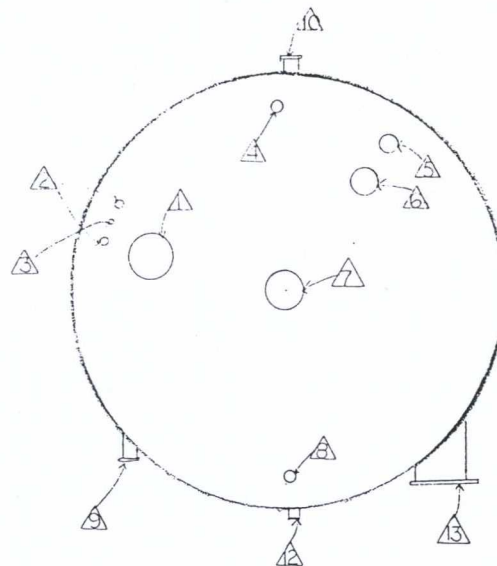
Exterior Coating Polyurethane Enamel

Tank To Be Selected (See Section D1.1)

Manufacturer

REMARKS:

Refer to drawing 43007



waste stored within it. More specific information on waste characteristics for the wastes stored in tanks is provided in Section C1.2, Wastes in Tank Systems.

In compliance with the requirements of 40 CFR 264 Subpart J, and WAC 173-303-640, tanks undergo tank integrity assessments. These assessments determine that the tank is adequately designed and has sufficient structural strength and compatibility with the waste to be stored or treated to ensure that it will not collapse, rupture, or fail. Tank assessments are certified by an independent, qualified, registered professional engineer. A schedule for periodic integrity assessments over the life of the tank is described in Section F2.2.3, Tank Condition Assessments.

Existing tanks at the Pier 91 Facility were fabricated to American Petroleum Institute (API) 612A design standards for riveted tanks. Planned tanks at the Pier 91 Facility are designed to Uniform Building Code (UBC) standards and the basic requirements of API 650 design standards (modified when necessary for cone-bottom tanks). API 650 design standards require additional tank wall thickness, appropriate for tanks which will hold some corrosive materials with specific gravities greater than 1.0. The specific corrosive allowance for each tank can be found in Appendix D-8, Tank Design Drawings, under the "structural steel" heading on each drawing. A protective coating to further prevent corrosion is applied to tanks as indicated on the Tank Data Sheets (see Figures D1-3 through D1-11). Tank integrity assessments also certify that certain corrosion engineering requirements more stringent than those of API 650 have been met. These include requirements that internal joints be seal-welded, and all internal weld defects be eliminated.

Design information for the dangerous waste tanks is summarized in Table D1-2, Design Information for Tanks. Tank design drawings are provided in Appendix D-8, and engineering certifications are provided in Appendix D-9. Tank placement is shown in Figure D1-2, Existing Dangerous Waste Tank System and Processing Area.

Tank manufacturers for the new carbon steel tanks will be selected based on technical capability to construct to the required design specifications. Tank manufacturer may be selected from the following manufacturers:

- Union Tank Works, Seattle, Washington
- Reliable Steel Co., Olympia, Washington
- Flohr Metal Fabricators, Seattle, Washington
- Seattle Boiler, Seattle, Washington

The following discussion provides detailed tank design and operating information.

The existing dangerous waste storage and treatment tanks are constructed of riveted and welded carbon steel and include flat bottom and cone bottom tanks. The proposed dangerous waste storage and treatment tanks will be constructed of welded carbon steel and include tanks of flat bottom and cone bottom design. The existing flat-bottom tanks are designed to store liquids according API 12A. All welds on planned tanks will be constructed according to API 650 standards.

Cone-bottom tanks are designed using API 650 for structural criteria including plate thickness, but the tanks are custom designed to provide a cone-bottom for facilitating sludge/solids removal. Design information for the conical

TABLE D1-2a. DESIGN INFORMATION FOR TANKS
 Revised, July 1990, December 1990, November 1991

TANK NUMBER	MATERIAL OF CONSTRUCTION/ DESIGN	DIAMETER (FT-IN)	HEIGHT (FT-IN)	MAX. S.G.	WORKING VOLUME (GAL)
2307- 2310, 2313	Carbon steel/ Flat bottom (coated)	11'0"	23'5"	1.2	14,100 ea.
2501 ⁽¹⁾	Carbon steel	10'0"	10'0"	1.2	5,287
2701, 2703, 2705- 2708	Carbon steel/ Flat bottom	28'8"	10'3"	1.2	44,657 ea.
2702, 2704	Carbon steel/ Flat bottom (coated)	28'8"	10'3"	1.2	96,555 ea.
2709, 2710	Carbon steel/ Flat bottom	23'0"	18'0"	1.2	52,832 ea.

(1) Not a RCRA-regulated tank.

bottom tanks is provided in Appendix D-8; engineering certifications are provided in Appendix D-9.

API 650 wall thicknesses used for tanks are shown in Appendix D-8.

In accordance with WAC 173-303-640(2)(a), the basis for selecting these minimum wall thicknesses is certified by a licensed professional engineer. This certification is provided in Appendix D-8.

Tanks containing corrosive materials will be protected from interior corrosion by a chemical-resistant coating material. Tanks which will be coated include tanks 2307-2310, 2313, 2702, 2704 and 2706. The coating used will be Thnemec Series 61 high solids catalyzed epoxy interior coating (or equivalent).

Specifications and chemical resistance data for possible coatings are included in Appendix D-2, Tank Interior and Exterior Coating Material Manufacturer's Data. Coatings will be inspected during the tank internal inspections as discussed in Section F2.2.3, Tank Condition Assessment. Based on the outcome of the tank inspections, this coating or equivalent will be reapplied per manufacturer's instructions to prevent interior deterioration of the tank wall.

All tanks will also be coated with an exterior coating material. The coating selected must be resistant to impact, abrasion, and ultraviolet rays and have excellent weatherability and durability. Specifications for potential exterior coating products are included in Appendix D-2. The tanks are externally inspected weekly to detect corrosion or coating damage. The selected coating will be reapplied as necessary.

A centrifuge (process equipment, unit #2601) is located in the existing RCRA facility. The centrifuge, a Sharples Model 3000, utilizes centrifugal force to separate materials of different densities, in this case, water and sludge/solids. The centrifuge consists of a bowl equipped with an auger conveyor. Sludge is introduced into the bowl which rotates at a very high rotational velocity separating the liquid and sludge into layers. The liquid layer is collected in a container and returned to a tank. The sludge is skimmed off by the auger conveyor and collected in a container. Design information typical of this equipment item is included in Appendix D-8 for informational purposes only.

Tank Foundations

40 CFR 264.193(c)(2)

The existing dangerous waste tanks are constructed with "ring-wall" foundations. Foundation drawings are included in Appendix D-8, Tank Design Drawings. The proposed tank secondary containment structures slope to facilitate drainage; therefore, the proposed tanks are situated on grout leveling pads constructed of Class B concrete. The proposed tanks are designed with base anchorage to resist sliding or overturning due to wind or seismic loads. Tank anchorage is designed to withstand the Uniform Building Codes' Exposure C wind loading and Zone 3 seismic loads (see Appendix D-10 for Seismic Evaluation).

The proposed tanks are anchored to grout leveling pads with steel brackets welded to the tanks and steel anchor bolts bonded with Sika Corporation's Sikadur Hi-Mod epoxy or equivalent. Individual tank anchoring configurations are shown on the tank design drawings in Appendix D-8, Tank Design Drawings.

Sump Systems

Collection sumps located in the tank storage/treatment, unloading areas, and loading/unloading pump area provide low points for drawing-off accumulated liquids within the bermed areas. Table D1-2b, Design Information For Tank System Sumps, provides the location and dimensions of the sumps located in the existing and proposed facility. Specific sump locations are shown in Figure D1-2, Dangerous Waste Tank System. The structural design of the tank secondary containment system is included in Appendix D-4, Secondary Containment System and Loading/Unloading Pad Designs.

Sumps/secondary containment systems will be constructed of concrete and sealed at construction joints with chemical resistant joint sealers and waterstops. Typical construction joints are shown on the design drawings for the tank pad in Appendix D-4. Manufacturer's data for sealing products are included in Appendix D-1, Manufacturers' Data for Concrete Coating and Sealing Products. Waste characteristics for wastes stored on the pad are identified in Section C1.0, Chemical and Physical Characteristics of Wastes, Appendix C-1, Typical Analyses of Wastes, and Table C1-3, Wastes in Tank Systems.

Sumps are lined with stainless steel attached to the concrete and sealed or coated with chemical resistant coating. If scheduled inspections of sumps indicate lining deterioration, new linings will be installed. Inspection information for sumps is provided in Sections F2.2.1,

TABLE D1-2b. DESIGN INFORMATION FOR TANK SYSTEM SUMPS
Revised, December 1990, August 1991, November 1991

SUMP NAME/LOCATION	STATUS	TOTAL VOLUME (GAL) PER SUMP	DIMENSION
Truck Loading/Unloading Pad Sump (collection only - no storage)	Existing	45	2'x2'x1.5'
Temporary Container Storage Area Sump (not RCRA-regulated)	Existing	45	2'x2'x1.5'
Load/Unload Pump Pad Sump (collection only - no storage)	New	45	2'x2'x1.5'
Dangerous Waste Tank System Sumps - Total(6) (collection only - no storage)	Existing	59 ea.	1.5'x3'x1.75'
Dangerous Waste Tank System Sumps - Total(7) (collection only - no storage)	New	45 ea.	2'x2'x1.5'

TOTAL SUMP CAPACITY = 810 GAL			

Container Inspection Schedule, and F2.2.2 Tank System Inspection Schedule.

The sumps and secondary containment structure are designed to have adequate structural integrity in that appropriate design codes were followed. They are designed to have sufficient strength and thickness to prevent failure caused by contact with the waste, pressure gradients, climatic conditions, and the stress of daily operations.

D1.2 Secondary Containment Systems for Tanks
Revised, December 1990, November 1991

WAC 173-303-640(2)(b), 806(4)(c)(vii)

This section describes the secondary containment system for the aboveground tank system at the Pier 91 Facility. The tank secondary containment system design prevents any migrated waste or accumulated liquid from escaping the system and entering the soil, groundwater, or surface water at any time during use of the tank system. The containment system is capable of collecting releases and accumulated liquids until the collected material can be removed. Design and construction information on the structural integrity of the tank system base and its ability to prevent migration of wastes or accumulated liquid is provided in this section.

D1.2.1 Design and Construction of Base
Revised, Jan 1990, Jul 1990, Dec 1990, Jul 1991, Aug 1991,
Nov 1991

40 CFR 264.193(c)(1) & (e)(1)
WAC 173-303 806(4)(c)(vii), 640(2)(b)

The tank system base and secondary containment system is constructed of, coated, or lined with materials having sufficient strength, thickness, and resistance to prevent failure owing to pressure gradients, physical contact with wastes, climatic conditions, and the stress of daily operations. The dangerous waste tank system is coated with Tnemec Series 66 epoxy primer and Tnemec Series 73 polyurethane topcoat (see Appendix D-1 for product specifications). The containment structure is on a base that is capable of providing support, resisting pressure gradients above and below the system, and preventing failure due to settlement, compression, and uplift. The certified engineering designs for the secondary containment system are included in Appendix D-4.

In accordance with 40 CFR 264.193(e)(1), the secondary containment system is designed and operated to contain the precipitation from a 25-year, 24-hour rainfall event. The tank secondary containment system design prevents horizontal and vertical migration of wastes.

The tank secondary containment system consists of an impermeable bermed concrete base sloped to sumps to collect liquids. The secondary containment structure is designed according to the standards of the American Concrete Institute, ACI 350-77, "Concrete Sanitary Engineering Structures". The structure is constructed of concrete, and reinforcement is provided by a double layer of tied rebar. Construction of the tank foundation is performed in accordance with ACI standards. Structural design information for the tank system containment structure is included in Appendix D-4.

The secondary containment structure for the proposed loading/unloading pad will be constructed over a portion of the existing concrete at the facility. Existing concrete will be decontaminated prior to being covered by new concrete. Foundation design parameters were obtained from a sub-surface investigation. The results of this investigation are included in Appendix D-6, Soil Study for Tank System and Loading/Unloading Pad.

Tanks constructed with "ring-wall" foundations have been retrofitted as shown in Appendix D-8, Design Information For Tanks (see drawing number 24008). The retrofitting plan included placement of a pea-gravel base and a new steel tank bottom over the existing tank bottom.

To facilitate proper drainage, the proposed loading/unloading pad and temporary container storage area secondary containment slopes towards the collection sumps.

The slope requires that tanks be placed on leveling pads or steel structures which compensate for the slope. Leveling pads are constructed of concrete and vary in thickness to compensate for the slope of the pad.

The impermeability of the containment system will be achieved by chemical resistant coatings and waterstops including sealants at construction joints. A typical construction joint detail is shown in Appendix D-4, Secondary Containment System and Loading/Unloading Pad Designs. Manufacturers' data for potential concrete coating and sealing products are included in Appendix D-1.

Tank system secondary containment areas are inspected daily to determine that structural integrity is unchanged. The floor, sumps, and curbing are visually examined for signs of deterioration or cracks. All cracks are repaired as specified in the construction specifications and the coating is reapplied, if necessary. In this way, secondary containment areas can be maintained free of cracks and gaps. Example inspection forms for the tank system areas are included in Appendix F-5, Example Tank System Inspection Forms. Completed forms are maintained on-file in the plant office at the facility. The tank system secondary containment areas are certified as free of cracks and gaps upon completion of construction.

D1.2.2 Containment System Capacity and Drainage Control

Revised, July 1990, December 1990, November 1991

40 CFR 264.193(b)(3)
WAC 173-303-640(2)(b), 806(4)(c)(vii)

The tank system secondary containment is designed to contain at least 100 percent of the volume of the largest tank in

the area. The system is also capable of containing precipitation from a 100-year/24-hour storm event. The supporting calculations for the containment system design are summarized in Table D1-3 and shown in Appendix D-5, Secondary Containment Calculations for Tank System and Loading/Unloading Pad.

The secondary containment pad slopes toward the sumps within the containment area to collect and contain spills and precipitation. The sumps are inspected daily. Sump contents are removed as discussed in Section D1.4 (Tank and Sump Operations and Management Practices). Slope and sump details are shown on the containment system design drawings in Appendix D-4. Sump pumping systems are discussed in detail in Section D1.4.

The berm height on the outside of the berm will be a minimum of 30 in. high. This height is sufficient to prevent run-on from a 100 year/24-hour storm, so secondary containment capacity for run-on need not be provided. This is demonstrated in the storm drainage study in Appendix D-7.

D1.3 Tank Corrosion and Erosion Prevention

Revised, Jan. 1990, July 1990, Dec. 1990, July 1991, Nov. 1991

WAC 173-303-806(4)(c)(ii), 640(3)(a)

Corrosion of tanks is prevented where necessary by the use of chemically resistant tank materials and interior and exterior coatings/linings. The chemically resistant tank materials and coatings/linings protect the tanks from accelerated corrosion, erosion and abrasion. To insure the effectiveness of these protection measures, tanks are regularly inspected.

TABLE D1-3. SUMMARY OF SECONDARY CONTAINMENT CALCULATIONS
FOR TANK SYSTEM
Revised, December 1990, August 1991, November 1991

ITEM DESCRIPTION	CALCULATION
100% of volume of largest tank	96,555 gal
100-yr/24-hr storm volume	44,548 gal
Required capacity	141,103 gal
Containment surface area	17,867 ft ²
Area taken up by tanks	6,041 ft ²
Effective area	11,826 ft ²
Containment area average depth	3.28 ft
Available capacity	280,690 gal
Sump capacity	354 gal (6 existing) 314 gal (7 planned)

TOTAL CONTAINMENT CAPACITY	281,358 gal

Dangerous waste storage and treatment tanks are constructed of carbon steel. This material is resistant to most of the oily wastes received at the Pier 91 Facility. Carbon steel is not resistant to the corrosive properties of the alkaline wastestreams and wastewaters received. To inhibit corrosion and erosion of carbon steel tanks from alkalis and wastewater, tanks containing these materials are coated or lined with chemically resistant materials.

Tanks containing wastewaters, alkaline materials, or used for heat treatment have an interior coating. The interior coating used will be Tnemec Series 61 high solids catalyzed epoxy (or equivalent). This material is resistant to alkalis and retards the corrosion process. Tnemec Series 61 or an equivalent product will be in place in the above tanks at all times. Specifications for this coating material are included in Appendix D-2, Tank Interior and Exterior Coating Material Manufacturers' Data.

Oil and coolant emulsions are stored and treated in carbon steel tanks. These operations do not attack carbon steel therefore, these tanks are not coated.

In compliance with the requirements of 40 CFR 264 Subpart J, and WAC 173-303-640, all new and existing tanks will undergo tank integrity assessments as described in Section D1.8, Tank Integrity Assessments. These assessments will demonstrate that the tank is adequately designed and has sufficient structural strength and compatibility with the waste to be stored or treated to ensure that it will not collapse rupture, or fail. The tanks have been certified to API 650 (welded construction) or API 12A (riveted construction) standards. Tank assessments will be certified by an independent, qualified, registered professional engineer. A schedule for periodic integrity

assessments over the life of the tank is described in Section F2.2.3, Tank Condition Assessment.

Tank internal inspections are conducted to detect early signs of corrosion/erosion and damage to the tank interior or coating (where applicable) per WAC 173-303-640(a) and (b). The frequencies of tank internal inspections are based on an in-house tank service rating system. The tank service rating system takes into consideration the hazard potential of waste material in the tanks as well as tank operation practices, material of construction, and corrosion protection used on the tank. Inspections are scheduled based on the severity of the tank service rating.

Steel tanks with a service rating of A or B will be provided with corrosion coupons installed in the vapor and liquid phases. These coupons will be inspected quarterly for signs of chemical attack and measured to determine material loss and corrosion rate. If a corrosion coupon inspection indicates accelerated corrosion or coating failure, an interior visual inspection will be scheduled within 90 days.

Interior visual inspections will also be carried out every two or three years, depending on the service rating of the tank. These inspections will be conducted by a qualified vessel inspector. Tank wall thickness measurements will be obtained as necessary using ultrasonic testing equipment.

The rating system and inspection program for tanks are discussed in Section F2.2.3, Tank Condition Assessment.

Corrosion of steel tanks will further be inhibited by use of an exterior coating. The exterior of all steel tanks will be coated with a material that is resistant to impact, abrasion, and ultraviolet rays. Specifications for potential exterior coating materials are included in

Appendix D-2. The steel tanks will be coated at all times with an exterior coating having equivalent or superior abrasion and chemical resistance properties. Tanks are externally inspected regularly for signs of exterior corrosion and coating damage.

Tank 2313 was constructed to API 650 standards. The planned carbon steel storage and treatment tanks will be constructed to API 650 standards (see Appendix D-8). Original wall thicknesses for the existing riveted tanks that were constructed to API 12A standards are 5/16" bottom, 1/4" shell, and 1/4" top. Wall thicknesses are measured by ultrasonic thickness tests in accordance with standard methods and practices. Tanks are inspected and thickness measurements recorded per the inspection schedule in Section F2.0. This information estimates an actual corrosion rate for each tank.

Calculating actual corrosion rates for each tank by obtaining periodic thickness measurements during tank internal inspections is the method to be used for assessing the life of the tank and the adequacy of wall thickness. Tank corrosion/erosion rates for new tanks can not be adequately evaluated from published corrosion data because:

- The chemical and physical characteristics of wastes received for tank storage and treatment vary, and the wastes are generally mixtures; therefore, selecting a pure material to be used for estimating a corrosion rate presents a potentially large degree of error. Also, there is a limited amount of corrosion data for materials at temperatures higher than ambient temperature.

- Treatment vessels may be subject to erosion from agitators or moderate velocities in the tanks. This is not accounted for in the estimated corrosion rates.
- Treatment chemicals are added to wastes in treatment tanks and may accelerate corrosion. Typical treatment chemicals used are listed below:
 - Hydrogen peroxide
 - Sodium bisulfite
 - Ferrous sulfate
 - Aluminum sulfate
 - Sodium hydroxide
 - Calcium hydroxide
 - Bleach
 - Ferrous chloride
 - Sulfuric acid
 - Ferric chloride
 - Sodium silicate
 - Calcium chloride

For reference purposes, data on corrosion rates of tanks by various chemicals was obtained from Corrosion Resistance Tables, (Marcel Dekker, Inc., Second Edition, 1986).

Corrosion rates were estimated by selecting chemicals with similar chemical characteristics and temperatures to the predominant waste stream(s) stored in each tank. A limited amount of data are available on corrosion rates at higher temperatures such as those encountered at the Pier 91 facility. The information that is available represents corrosion by pure substances, not mixtures of waste materials; thus, the materials selected to estimate corrosion rates are not necessarily the most common contaminants encountered. Those materials have the most applicable corrosion data and similar chemical properties to the more commonly encountered wastestreams. The estimated corrosion rates are summarized in Table D1-4, Estimated Corrosion Rates of Tanks. Actual corrosion rates will be determined through field tests.

D1.4 Tank and Sump Operations and Management Practices
Revised, January 1990, July 1990, November 1991

40 CFR 264.194, 270.16(i)

WAC 173-303-806(4)(c)(iv) & (v), 640(3)(b)

This section describes tank operations and management practices associated with transfer and treatment of wastes in storage and treatment tanks. Tank treatment processes are summarized along with the equipment and procedures used to prevent overfilling of tanks and accidental spills. Detailed process/activity descriptions are discussed in Section B1.5, Detailed Process/Activity Descriptions. Sump pumping systems are also described in this section.

Wastes are stored and treated in the tank system as described below. Wastes destined for the tank system enter the facility in tanker trucks. The waste is unloaded from the truck within the bermed unloading pad. Sound operating practices are followed to prevent spills, fires, or explosions during loading and unloading. Safe transfer practices include the following:

- (1) Prior to unloading, all transfer hoses, connections, and pumps are checked for damage or deterioration and are inspected weekly per the inspection schedule in Table F2-1, Inspection Schedule for Operational Equipment.

TABLE D1-4. ESTIMATED CORROSION RATES OF TANKS
Revised, July 1990, December 1990, November 1991

TANK NUMBER	TANK MATERIAL	WASTE STORED OR TREATED	MATERIAL USED FOR ESTIMATING CORROSION RATE (1)	CORROSION RATE (2) (IN/YR)
2307- 2310, 2313	Carbon steel coated w/ epoxy	Oil/coolant wasteater metals ($< 200^{\circ}\text{F}$)	Aliphatic hydrocarbons Alkaline sol.(25%) Ethanol Toluene Xylene Hydrogen peroxide (30%)	resistant " " " "
2703, 2706, 2708	Carbon steel coated w/ epoxy	Oil/coolant with solvents/ metals ($< 200^{\circ}\text{F}$)	Same as 2307-2310,2313	resistant
2709, 2710	Carbon steel	Oil with solvents/ metals (ambient)	Mineral oil Lubrication oil Machine oil Xylene Methylene Chloride Phenol (10% conc.)	resistant
2701, 2702, 2704	Carbon steel coated w/ epoxy	Wastewater with solvents/ metals ($< 200^{\circ}\text{F}$)	Same as 2307-2310, 2313	resistant
2705, 2707	Carbon steel coated w/ epoxy	Wastewater with solvents/ metals (ambient)	Wastewater Aliphatic hydrocarbons Salt solutions Mineral oils Alkali solution	resistant

(1) The materials selected to represent solvent wastes represent all chlorinated and non-chlorinated solvents received. The materials listed for tanks operating above ambient temperature are not necessarily the most common materials encountered in these tanks, but they have the most complete corrosion data at higher temperatures and are similar to the actual wastestreams.

(2) Corrosion rates obtained from Corrosion Resistance Tables, (Marcel Dekker, Inc., Second Edition, 1986).

(3) Corrosion rates with coating obtained from TNEMEC-PROTECTIVE COATING; series 46-413 and 61.

- (2) During loading/unloading a truck, the truck driver and at least one Chemical Processors plant operator are present. The driver sees that the parking brake is set securely. The driver never leaves the vehicle unattended and does not remain in the vehicle during transfer. The plant operator is instructed in proper transfer procedures and is alerted to all potential problems (overfilling, leaks, spills, vapor, or liquid explosions, fire, etc.). The driver and plant operator are instructed to remain alert and aware of operations at all times during the waste transfer process.
- (3) Loading and unloading of tanker trucks is conducted only within the designated loading/unloading pad which complies with WAC 173-303-395(4) and is designed to provide containment for the truck capacity. Containment calculations for the loading/unloading pad are presented in Appendix D-5, Secondary Containment Calculations for Tank Systems and Loading/Unloading Pad.
- (4) In the transfer of flammable liquids, motors of tank vehicles or auxiliary or portable pumps are shut down during making or breaking of hose connections and are grounded to avoid the potential of sparking. If the motor of the tank vehicle is not required for the loading/unloading process, the motor remains off throughout the transfer of the liquid.
- (5) In transfer operations involving volatile liquids, a minimum 1% space or tank outage is provided to account for thermal expansion of the transferred liquid.

In the event that spills occur during unloading and transfer of material, spill response procedures are established for

the facility per WAC 173-303-640(4)(c) and are discussed in Section G3.3.3, Spills and Releases.

In addition to sound operating procedures for preventing overfilling of tanks and spillage during transfers, tanks are equipped with engineering controls. The primary overfill control device is the tank overfill monitoring system which is installed on all storage and treatment tanks. Tanks are also equipped with lever gauges on the outside of the tank wall which indicate the liquid level in the tank.

The overfill monitoring system consists of an ultrasonic or other liquid level sensor which causes an alarm to sound and visual indicators on a control panel to activate when the liquid reaches the pre-set level in the tank. An operator then cuts off the feed pump and pushes the "Acknowledge" button on the control panel which turns off the alarm. The visual indicators on the panel remain lit while high-level conditions exist. Figure D1-12, Existing Dangerous Waste Area Piping and Instrumentation Diagram, shows the overfill monitoring system.

The preset maximum liquid level which is monitored by the high-level switch on tanks is maintained at 1 foot of freeboard. Overtopping by wind or precipitation is not a concern because all tanks are protected by fixed-roofs.

Facility piping is also designed to minimize the potential for waste releases. Suction and fill connections on each tank are labeled as such, minimizing potential operator error. All piping used for transferring dangerous wastes is aboveground and located within secondary containment. The piping and instrumentation drawing for the tank system is included as Figure D1-12, Existing Dangerous Waste Area Piping and Instrumentation Diagram. Information on transfer pumps within the tank system is presented in Table

D1-5. The flow of wastes within the plant is described below.

Treatment of wastes in tanks is described according to the waste category being treated. (Refer to process flow diagrams, Figures B1-3 through B1-7, and detailed process descriptions in Section B1.5, Detailed Process/Activity Descriptions.) Waste characteristics and categories are discussed in Section C1.1, Wastes Generated Off-Site. The treatment processes are described according to the following waste categories:

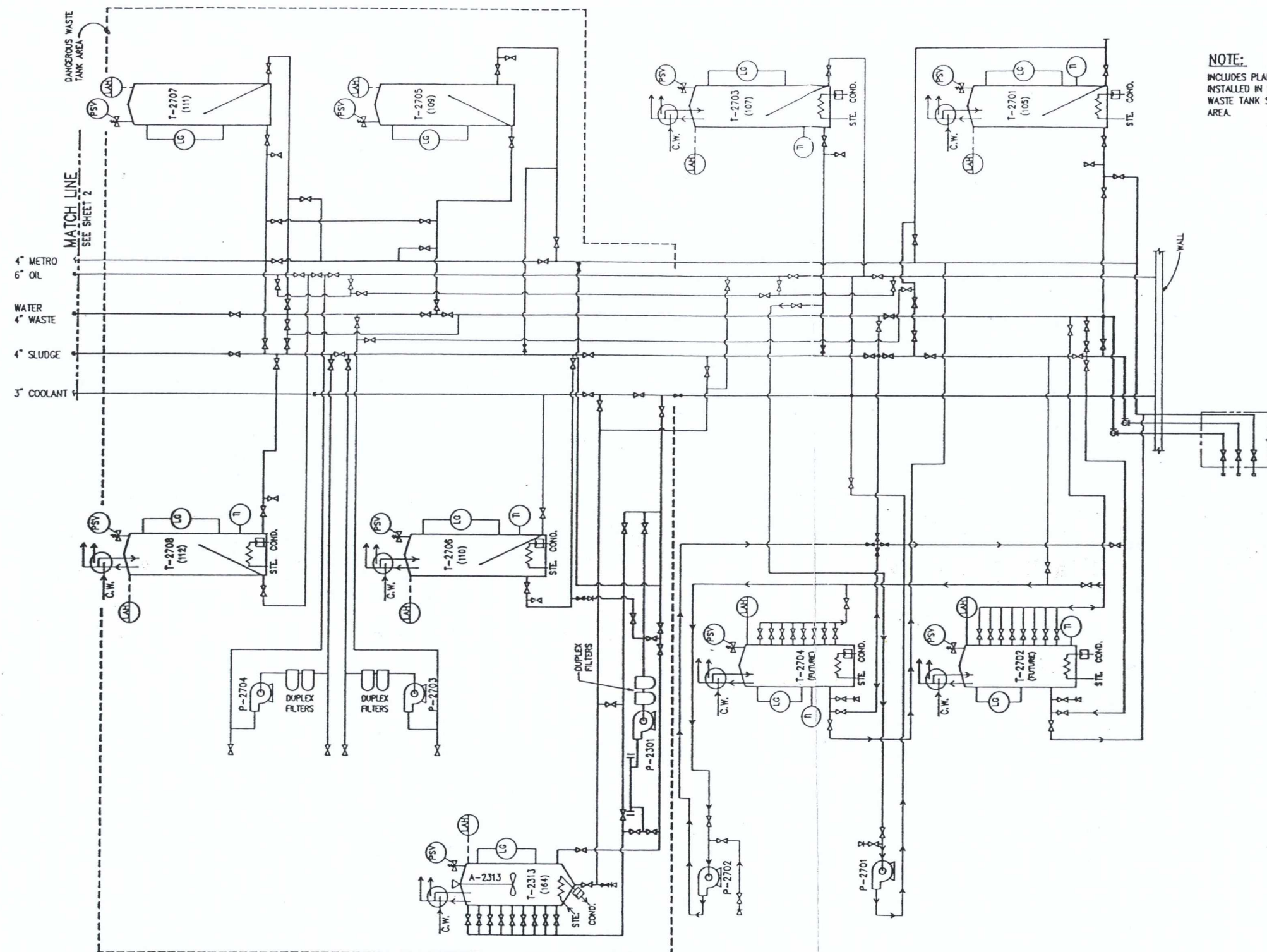
- Oil and coolant emulsions
- Industrial wastewaters including alkalis
- Industrial waste sludge

Contaminants may include phenolics, metals, and solvents.

The tanks in which wastes are stored and treated are identified in Table C1-3, Wastes in Tank Systems. The process tolerance limits for the treatment processes described below are identified by number on the process diagrams in Section B and are listed in Table B1-3, Process Tolerance Limits/Process Parameters.








Oil and Coolant Emulsions (Figure B1-3)

Incoming emulsified materials are segregated based on flashpoint, compatibility and the presence of phenolic contaminants and are stored in Tanks 2703, 2706 and/or 2708-2710. Oil and coolant emulsions with a flashpoint of less than 100°F are not unloaded, and the generator is notified. The shipment is either returned to the generator



NOTE:
INCLUDES PLANNED TANKS TO BE
INSTALLED IN EXISTING DANGEROUS
WASTE TANK SYSTEM AND PROCESSING
AREA.

Figure D1-12, page 1 of 2

	11-14-91		SPLIT BNC 20002, SHT. 1 INTO SHT. 1 AND 2
	8-2-91		REVISE EXISTING AND FUTURE
	7-19-91		ADD FUTURE TANKS & EQUIPMENT
	7-16-91		ADD METRO LINE PIPING
	5-7-91		MODIFY T-2313 PIPING
	5-2-91		AS-BUILT
	12-28-90		INITIAL RELEASE
DATE	BY	APPROVED	REVISION
<div>CHEMICAL PROCESSORS, INC. 2203 AIRPORT WAY SO., SUITE 400 SEATTLE, WASHINGTON 98134</div>			
EXISTING DANGEROUS WASTE TANK AREA PIER 91 FACILITY PIPING AND INSTRUMENTATION DIAGRAM			
REVISION	DATE	BY	APPROVED
0001	20002	DATE	1-2

P & ID NOMENCLATURE

FIRST LETTER		SUCCEEDING LETTERS		
MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A ANALYSIS		ALARM		
B BURNER COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C CONDUCTIVITY (ELECTRICAL)			CONTROL	CLOSED CHOICE
D DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E VOLTAGE (EMF)		PRIMARY ELEMENT		
F FLOW RATE	RATIO (FRACTION)			
G USER'S CHOICE		GLASS		
H HAND (MANUALLY INITIATED)				HIGH
I CURRENT (ELECTRICAL)		INDICATE		
J POWER	SCAN			
K TIME OR TIME-SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L LEVEL		LIGHT (PILOT)		LOW
M MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTERMEDIATE
N USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O USER'S CHOICE		ORFIDE (RESTRICTION)		OPEN
P PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R RADIATION		RECORD OR PRINT		
S SPEED OR FREQUENCY	SAFETY		SWITCH	
T TEMPERATURE		TRANSMIT		
U MULTIVARIABLE		MULTIFUNCTION		MULTIFUNCTION
V VISCOSITY		VALVE, DAMPER, OR LOUVER		
W WEIGHT OR FORCE		WELL		
X UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y EVENT, STATE OR PRESENCE		RELAY OR COMPUTE		
Z POSITION		DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT		

TANK TABLE

2701 (105)	INDUSTRIAL WASTE WATER TREATMENT/STORAGE TANK
2705 (109)	TREATMENT/STORAGE TANK
2707 (111)	TREATMENT/STORAGE TANK
2702 (PLANNED)	TREATMENT/STORAGE TANK
2704 (PLANNED)	TREATMENT/STORAGE TANK
2703 (107)	WASTE OIL TREATMENT/STORAGE TANK
2708 (112)	WASTE OIL TREATMENT/STORAGE TANK
2706 (110)	OIL/COOLANT TREATMENT & STORAGE TANK
2709 (PLANNED)	WASTE OIL STORAGE TANK
2710 (PLANNED)	WASTE OIL STORAGE TANK
2313 (164)	HEATED TREATMENT/STORAGE
2307 (PLANNED)	HEATED TREATMENT AND STORAGE TANK
2308 (PLANNED)	HEATED TREATMENT AND STORAGE TANK
2309 (PLANNED)	HEATED TREATMENT AND STORAGE TANK
2310 (PLANNED)	HEATED TREATMENT AND STORAGE TANK

LEGEND -- PIPING (FOR PIPE SUPPORT SURVEY)

---	EXISTING (INCLUDING VALVES)
---	FUTURE (INCLUDING VALVES)

P & ID SYMBOLS

LEGEND

	CENTRIFUGAL PUMP
	BELT CONVEYOR OR DRAG-LINK CONVEYOR
	INSTRUMENT FOR SINGLE MEASURED VARIABLE AND ANY NUMBER OF FUNCTIONS. INSTRUMENT IS LOCALLY MOUNTED
	FRONT-OF-MAIN-PANEL-MOUNTED INSTRUMENT

	AGITATOR
	PRESSURE/VACUUM RELIEF VALVE WITH FLAME ARRESTOR
	PRESSURE RELIEF VALVE SPRING-LOADED
	PRIMARY PROCESS FLOW
	SECONDARY PROCESS FLOW

	DIRECTION OF FLOW
	HOSE CONNECTION
	ATMOSPHERIC VENT
	LINE BREAK OR RESUMPTION POINT
	GATE VALVE (OR GENERAL UNDEFINED VALVE TYPE)
	STRAINER

	TRANSFER VESSEL FOR WASTE GENERATED ON-SITE
	STEAM TRAP, THIS IS EQUIVALENT TO :
	HEAT EXCHANGER
	LINE DRAIN WITH SCREWED CAP OR PLUG (FOR SLUDGE TRANSFER)

DL-12, page 2 of 2

11-14-91	INITIAL RELEASE - SPLIT FROM SHT. 1, REV. A
CHEMICAL PROCESSORS, INC.	
2203 AIRPORT WAY SO., SUITE 400 SEATTLE, WASHINGTON 98134	
EXISTING DANGEROUS WASTE TANK AREA PIER 91 FACILITY PIPING AND INSTRUMENTATION DIAGRAM	
DATE	20002
REV.	2-2

TABLE D1-5. TANK SYSTEM TRANSFER PUMP INFORMATION
 Revised, July 1990, December 1990, November 1991

PUMP #	USAGE	DESIGN INFORMATION
P-2101	Sludge transfer	Planned - to be selected. 50 gpm
P-2102	Waste oil/coolant Loading and unloading	Planned - to be selected. 400 gpm
P-2103	Waste oil/coolant Loading and unloading	Planned - to be selected. 400 gpm
P-2104	Unloading industrial wastewater	Planned - to be selected. 400 gpm
P-2301	Mixing and treated wastewater/oil/coolant transfer.	Worthington D1010, 3x2x6 centrifugal pump, 5.5HP, 6.5" impeller.
P-2302	Treated wastewater/oil/ coolant transfer	Planned - to be selected. 200 gpm
P-2303	Treated wastewater/oil/ coolant transfer	Planned - to be selected. 400 gpm
P-2701	Mixing and treated wastewater transfer	Planned - to be selected. 400 gpm
P-2702	Mixing and treated oil/ coolant transfer	Planned - to be selected. 400 gpm
P-2703	Mixing and treated oil/ coolant transfer	Planned - to be selected. 400 gpm
P-2704	Mixing and treated wastewater transfer	Planned - to be selected. 400 gpm
P-2705	Mixing and treated oil/ coolant transfer	Planned - to be selected. 400 gpm

or sent to another RCRA-permitted facility. Chromium wastes are also segregated. After sampling the consolidated wastes, an appropriate treatment method is determined by applying a Trial Treatment to the samples.

Oil and coolant emulsions are treated in the Heated Treatment Tanks (2307-2310, and 2313). If the wastestream contains hexavalent chromium, it undergoes chemical reduction at an optimum pH of 2-4. If the wastestream contains phenolic contaminants it undergoes chemical oxidation at an optimum pH of 2-4.

The wastestream is then demulsified using the most appropriate combination of treatments based on the results of the Trial Treatment. The treatment includes heat treatment, chemical precipitation, dewatering, clarification and flocculation or various optimum combinations of these treatments.

Demulsification results in 3 phases: water, oil, and sludge. The water phase is transferred to a water discharge tank. Any tank currently in service can be utilized for water discharge. The oily and sludge phases are transferred to a Sludge Storage Tank (2310) for sedimentation and decanting, and the settled sludge is typically centrifuged (process equipment) and treated at an off-site RCRA-permitted facility.

Industrial Wastewaters including Alkalis (Figure B1-4)

Wastewaters and alkalis arrive at the facility and are segregated based on compatibility. These wastes are stored in the tanks identified in Section C1.2, Wastes in Tank System. Industrial wastewaters with a flashpoint of 100°F

or less are not unloaded: the generator is notified, and the waste is either returned to the generator or sent to an off-site RCRA-permitted facility. Industrial wastewaters and alkalis may be treated for metals contamination, neutralized or treated for phenolics.

Metals treatment occurs in Tanks 2307-2310 and 2313. If chromium is detected in the initial screening, a reducing agent is added to the waste in Tanks 2307-2310 and 2313 until the chromium concentration meets the discharge parameters. Chemical reduction of hexavalent chromium (Cr^{+6}) to trivalent chromium (Cr^{+3}) occurs at an optimum pH of 2-4.

The wastestream is then neutralized, ideally to pH 5-9, to promote metals precipitation. The wastestream then undergoes metals precipitation and flocculation. Once solids have settled, the waste is decanted. The treated supernatant is transferred to the any available tank currently in service for discharge. The sludge is transferred to a Sludge Storage Tank (2310) for clarification, sedimentation, and decanting, and is then centrifuged (process equipment) and/or treated/disposed of at an off-site RCRA-permitted facility.

If phenolic contaminants are detected in the initial screening of a wastewater or alkali, this material is stored and treated in Tanks 2307, 2310 and 2313. Phenolic contaminants are treated by oxidation at an optimum pH of 2-4. The material then undergoes metals treatment, if necessary, as described above.

Industrial Waste Sludges (Figure B1-5)

Wastewater sludges received at the facility or generated on site are consolidated with other compatible sludges in the sludge storage tank (2310). Oily sludges are segregated from non-oily sludges. The consolidated sludge is dewatered through sedimentation and decanting. The sludge is then sent off site for treatment and disposal or centrifuged and then sent off site.

The clarified supernatant from decanting and centrifugation is transferred to a storage or treatment tank for ultimate treatment and discharge. All of the tanks currently in service are capable of wastewater storage.

Sump Pumping Systems

Sumps and sump pumping systems are used to collect and remove liquids which accumulate from precipitation, spills, equipment decontamination, and tank cleaning operations.

The secondary containment leak detection system consists of daily inspections to detect leaks and accumulated liquids. Liquids are removed within 24 hours or in a timely manner. For non-operating days, arrangements will be made for these inspections. Refer to Section F2.0 for inspection information.

Accumulated liquids in sumps are pumped according to whether or not contamination is suspected. Since liquids are removed from sumps regularly during shifts, and storage and treatment tanks are inspected frequently for leakage, accumulated rainwater is assumed to be uncontaminated and is pumped to a storage tank and analyzed prior to discharge.

Material in sumps is suspected to be contaminated if any of the following occurs:

- leaking tanks are visually noted;
- spillage occurs during material transfer;
- evidence of spillage from other sources is detected.

If it is suspected that a sump contains spilled material, the accumulated material is analyzed according to the constituents of the material that is stored in the containment area. If contaminated, the contents of the sump are transferred to an appropriate storage vessel depending on storage capacity availability and compatibility.

Areas containing spilled material are pumped using a portable sump pump into an empty labeled drum(s), tank or tanker truck depending on the quantity of liquid collected. This material is then stored in the drum(s) or tank within a compatible storage compartment and treated, or sent to an off-site RCRA-permitted treatment/storage/disposal facility. When equipment decontamination occurs (restricted to secondary containment areas), the rinsewater is immediately removed from the sumps and transferred to a compatible tank or container.

D1.5 Labeling of Tanks

Revised, December 1990, November 1991

WAC 173-303-395(6), 640(2)(c), 806(4)(c)(viii)

All dangerous waste storage and treatment tanks are labeled on two sides of the tank in black letters identifying the type of waste contained and the tank number or name. Tanks are painted a light color providing a contrast for the black lettering and enhancing visibility. Waste

identification labels are lettered in 3 inch-high letters (minimum) and are located at approximately eye level. Tank numbers or names are a minimum of 9 inches high and located at approximately eye level. These labels are visible from a distance of 50 feet or more. The waste identification label for each tank is identified under the "Tank Name" on the Tank Data Sheets, Figures D1-3 through D1-11. Tank numbers will be the same as numbered on the Tank Data Sheets.

Dangerous waste tanks are also labeled to identify the major risks associated with the waste being stored. At all times, tanks containing dangerous wastes, extremely hazardous wastes, or hazardous materials are labeled with appropriate labels which identify the major risks associated with the contents for employees, emergency personnel, and the general public. Labels are inspected per WAC 173-303-395(6) to insure that labels are not obscured, removed, or unreadable. Hazardous Materials Identification System (HMIS) or National Fire Protection Association (NFPA) labels are used.

Hazardous Materials Identification System (HMIS) labels provide information on waste characteristics which identify the major risks associated with the waste being stored. The HMIS labeling system includes information on health hazard, flammability, reactivity, and personal protection. Hazards are rated from 0 to 4 (minimal hazard to severe hazard) indicating the degree of severity associated with that hazard. HMIS labels are color coded as follows: blue indicates health characteristics, red-flammability, yellow-reactivity, and white-personal protection. The HMIS labels are 10.5 inches by 13.5 inches and are located at approximately eye level. These labels can be seen from a distance of 50 feet. Legend signs explaining the HMIS labeling system are located throughout the plant.

Tanks may also be labeled with NFPA labels in addition to the tank number and material contained. The NFPA labels provide information on waste characteristics such as reactivity, flammability, and health hazard. Additional information such as reactivity with water and other special fire fighting information is provided on this label as well.

The hazard characteristics are color coded on the label. The color yellow indicates reactivity, red-flammability and blue-health characteristics. Each characteristic is rated from 0 to 4 indicating the degree of hazard ranging from 0 as no special hazard, to 4 as a severe hazard. The NFPA labels are typically 12 inches-square and each character is approximately 3 inches high resulting in visibility from a distance of 100 feet.

D1.6 Control System Design for Air Emissions from Tank Systems

Revised, July 1990, December 1990, May 1991, November 1991

40 CFR 264.192

WAC 173-303-806(4)(c)(vii) & (ix), 640(2)(b) & (d)

Air pollution control systems are employed on tanks and activities which contain extremely hazardous wastes (EHW) and present the potential for emissions which are acutely or chronically toxic by inhalation. These emissions are discussed in Section C1.2, Wastes in Tank Systems. The controls are discussed in the following paragraphs, and design calculations are presented in Appendix D-3, Design Calculations for Air Pollution Control Equipment. Vent piping diagram are included as Figure D1-25, Existing Dangerous Waste Area Piping and Instrumentation Diagram. At all times, the control equipment discussed in this section or equivalent will be employed on tanks and

processes requiring air controls as dictated by emission toxicity. A program for monitoring, testing, repair and recordkeeping associated with air emissions from process vents and equipment leaks is included as Appendix F-8, Air Emission Monitoring Program for Process Vents and Equipment Leaks.

Condensers

The heated treatment and storage tanks (2307-2310, and 2313) are used for treating oil and coolant emulsions potentially contaminated with solvents and/or phenolics. When wastes are heated during treatment, organic contaminants may be volatilized. These tanks will be equipped with condenser systems to control steam and odors and potential organic emissions. The control systems condense the organic contaminants and steam and return the liquid to the tank system. (Refer to Appendix D-3 for design calculations.) The condensers will be inspected as indicated in Section F2.0, Inspection Schedule.

D1.7 Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes in Tanks

Revised, July 1990, Dec. 1990, Sept. 1991, Nov. 1991

40 CFR 270.16(f), 264.198 & 199

WAC 173-303-806(4)(c)(vi), 640(6) & (7), 395(a)

Ignitable wastes with a flashpoint of less than 100°F are accepted at the Pier 91 Facility for isolation storage as specified in Section C2.2, Identification of Wastes and Restricted Wastes. Reactive wastes are unacceptable at the facility.

Ignitable wastes with a flashpoint of 100°F or greater are accepted for storage and treatment in tanks.

Ignitable Wastes

Ignitable wastes (flashpoint = 100°F - 140°F) are accepted for storage and treatment in tanks 2307-2310, 2313, 2703, 2706 and 2708-2710. Ignitable wastes are consolidated with compatible ignitable materials. This consolidation does not render the waste non-ignitable, but ignitable storage is protected from any material or conditions which may cause the waste to ignite and so complies with WAC 173-303-640(6)(a)(ii). The waste is stored away from ignition sources in an open area as discussed in Section F5.1, Precautions to Prevent Ignition. "Danger-No Smoking, No Open Flames" signs are posted prominently in the dangerous waste storage area, and smoking is confined to specific areas away from storage and treatment areas.

Potential ignitable storage tanks are adequately located away from (a) a property line which is or can be built upon and (b) the nearest side of any public way or from the nearest public building or save property, as required by the National Fire Protection Association's buffer zone requirements for ignitable or reactive wastes (refer to Section B6.0). The minimum required distance from ignitable or reactive storage tanks to a property line, which is or can be built upon or to the opposite side of a public way, is 10 feet, and the minimum required distance to the nearest important building on site or to the near side of a public way is 2.5 feet. At the facility, the actual minimum distance from ignitable storage tanks to a property line is 28 ft and to the nearest important building or a public way is 7 ft (see Table B6-1, Buffer Zones For Tanks).

Incompatible Wastes

Wastes are tested for compatibility prior to consolidation in tanks, and incompatible wastes are not stored in the same

tank. Waste incompatibility for all wastes is determined by the procedures described in Section C2.4.5, Analytical Test Methods. Waste profiles and check-in procedures are discussed in Section C2.6, Requirements for Incoming Wastes.

Before a tank can be used for a material which is incompatible with residue in the tank, the tank is cleared of all residual waste. Incompatible wastes or materials are not stored in the same tank or in an unwashed tank that previously held an incompatible material unless the requirements of WAC 173-303-395(1)(b) are met.

D1.8 Tank System Integrity Assessments Revision, January 1990

This section addresses the revised January 1989 Tank Regulations of WAC 173-303-640. Evaluation procedures for certifying tank integrity are described below for Existing and Proposed Tank Systems.

D1.8.1 Existing Tank Integrity Assessment Program

Revised, July 1990

40 CFR 265.191

WAC 173-303-640(2)

The tank integrity assessment is conducted to determine that the tank system is designed and has sufficient structural strength and compatibility with waste(s) such that it will not collapse, rupture, or fail. The assessment is reviewed and certified by an independent, qualified registered professional engineer. A copy of the written assessment is kept on file at the facility.

The tank integrity assessment for existing tank systems considers the design standard to which the tank system was constructed, or design standard used to evaluate for certification. Where applicable, atmospheric tank system designs are certified using codes such as API 650 or API 12B as standards. Process equipment items, where applicable, are certified to ASME Boiler and Pressure Vessel Codes.

The tank integrity assessment provides for an evaluation of the following items:

- (1) the dangerous characteristics of the wastes that have been or will be handled in the tank system,
- (2) the existing measures for the control of corrosion in tank systems,
- (3) the documented or estimated age of the tank system,
- (4) design drawings, and
- (5) the results from either a leak test, internal inspection, or other tank system integrity examination that addresses cracks, leaks, corrosion, and erosion.

Enterable tanks are certified by the registered independent engineer after a thorough integrity examination. This integrity examination consists of both internal and external inspections. Each enterable tank is entered using appropriate confined space entry procedures as described in Section F2.2.3, Tank Condition Assessments. The top, side and bottom shells and welds are inspected for cracks, leaks, corrosion, erosion and general condition. The results of these internal inspections are written in the integrity assessment.

External inspections of tanks include visual inspection of tank shell and welds for cracks, leaks, corrosion, erosion, and general condition. Ultrasonic thickness measurements are taken from the top, sides and bottom of all tanks. Tank support structures are inspected for cracks, corrosion and weld conditions. The results of these external tests are documented in the tank integrity assessment. The registered engineer will then certify acceptable tank systems.

If the independent assessment indicates that modifications to tanks should be performed, tanks will be upgraded to meet an acceptable level of structural integrity before certification is issued.

If a visual internal inspection on a tank cannot be performed then a leak test is performed. The leak test takes into account effects of temperature variation, tank end deflections, vapor pockets, and high water table effects. Leak testing is performed in accordance with API, ANSI/AMSE, or other nationally recognized standards. The tank standard used and results from the leak test are documented in integrity assessment.

Ancillary equipment is normally assessed for integrity using a hydrostatic or other form of leak test carried out at design pressure. If warranted, alternative testing methods including visual inspection and ultrasonic thickness testing may be performed. Vendor-engineered ancillary equipment, such as centrifuges and vapor condensers, are subject to various assessment methods depending on size, shape and design.

Tanks and ancillary equipment found to be leaking or unfit for use are removed from service and either repaired, replaced or taken out-of-service. Repairs are certified

pursuant to WAC 173-303-640(7)(f). Leaks are subject to the reporting requirements of WAC 173-303-640(7)(d).

Section F2.2.3, Tank Condition Assessment, provides a schedule for continuing integrity assessments based on materials of construction and characteristics of waste(s) handled over the life of the tank.

Tank integrity certifications for existing tanks are presented in Appendix D-9, Engineering Certifications.

D1.8.2 New Tank Design and Installation

Revised, July 1990

40 CFR 265.192

WAC 173-303-640 (3)

New tanks must have a written assessment from a independent, qualified registered professional engineer attesting that tanks have sufficient structural integrity and are acceptable for storing and treating dangerous waste. The assessment is conducted to demonstrate that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tanks have sufficient structural strength and compatibility with the waste(s). The assessment describes the method of corrosion protection used to ensure that tanks will not collapse, rupture, or fail. The assessment also includes the design drawings and design standard according to which tank systems are constructed and a discussion of the dangerous characteristic of wastes to be stored or treated. New tank systems or components, in which an external shell of a metal tank or any external metal component of the tank system will be in contact with

the soil or with water, will be assessed in accordance with WAC 173-303-640(3)(a)(iii).

The structural integrity assessment for new tanks demonstrates that tank foundations will maintain the load of a full tank. The assessment also verifies that ancillary equipment will be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

Section F2.2.3, Tank Condition Assessment, provides a schedule for continuing integrity assessments based on materials of construction and characteristics of waste(s) handled over the life of the tank.

New tanks are installed using proper handling procedures to prevent damage to the tank system during installation. Before being placed in use, an independent professional engineer or qualified installation inspector inspects the tank system for the items listed below:

- (1) breaks, punctures, scrapes, corrosion, and any other structural damage,
- (2) inadequate construction/installation, and
- (3) tightness prior to being placed in use.

Tightness testing is performed with either pressurized air or aqueous solutions. Leaks located during tightness testing will be repaired.

Tanks will not be placed in use if leaks are found. Any discrepancies noted during the pre-installation inspection will be corrected before tanks are placed in service. An independent corrosion specialist will determine the type and degree of corrosion protection required for tank systems, based on exposure conditions. The installation of

a corrosion protection system that is field fabricated will be supervised by an independent corrosion expert to ensure proper installation. Written statements by those supervising the installation will be kept on file at the facility. The written statements certify that the tank system was properly designed and installed and that repairs, where needed, were performed.

Tank integrity certifications for planned tanks are presented in Appendix D-9, Engineering Certifications.